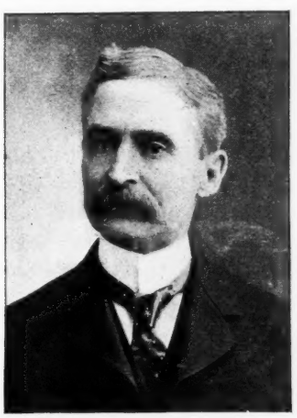
MUNICIPAL JOURNAL AND ENGINEER

VOLUME X NEW YORK, APRIL, 1901 No. 4

STONE PAVEMENTS.

BY GEORGE W. TILLSON, C. E., BROOKLYN, N. Y.



GEORGE W. TILLSON, C. E., Brooklyn, N. Y.

No matter how popular asphalt may become as a paving material, no matter how desirable brick may be for the same purpose, stone pavement will always be laid in some localities, both on account of its availability and the needs of traffic, as long as the present method of carrying on the commerce of our great cities prevails.

The first pavements or artificial roads of which we have any record were constructed of stone, and the material has been in constant use down to the present time.

Pavements in early days were not considered a necessity until cities had attained considerable size, and our ancestors were not much given to luxuries, especially in public works.

In the United States, the first pavements were laid in Boston and New York at about the same time. The first street paved in the latter city was Stone street, in 1656, the material being cobble stones. This was the most available material at the time, and naturally was used. Its use was continued as almost the only paving material in New York until 1849, although wood and other materials had been previously experimented with. It was also used extensively in Brooklyn, Philadelphia, Boston and Baltimore; these being the principal commercial cities of those times. To what extent it was adopted and continued in Philadelphia can be seen from the fact that in 1884 that city had 535 miles of pavements, of which 93 per cent. was cobble. An attempt was made in 1843 to improve the pavements of this city, when it was recommended that two stone tramways should be built in all streets paved with cobblestones. This recommendation, however, was never carried out.

Brooklyn, in 1888, had about 340 miles of this pavement, but it had been reduced to 227 miles in 1900, while in Philadelphia there were only 69 miles on January 1 of the same year.

Any writing on cobble pavements at the present time can have very little practical value, but it is of interest to know what has been done in this direction. Illustration No. 1 shows a cobble stone pavement laid in Brooklyn some twenty years ago. It is in good condition and can be taken as a good example of its kind; No. 2, however, shows in what condition such a pavement will reach when improperly laid of poor material and not well taken care of. The specifications generally required the stones to be of the best water or bank cobblestones with round heads and well shaped ends, varying in size from 4 to 8 inches across the head, and from 5 to 10 inches in depth. These specifications, however, have been shamefully abused in every particular, resulting in such pavements as shown in the illustration. The writer once measured a stone in a Brooklyn pavement that was 3 feet 10 inches long and 11 inches wide. In another street a stone was found that required blasting before it could be removed. Cobblestone pavements never gave satisfaction because they were noisy, rough and could not be kept clean. Under heavy traffic they were expensive to maintain, as the stones of themselves would not bond, depending for this property upon the material in which they were imbedded.

Although cobblestones have been used to some extent in Europe they did not form so large a proportion of the first

NO. I.—CLERMONT AVENUE, BROOKLYN—PAVED MORE THAN TWENTY YEARS AGO.

NO. 2.—EIGHTH AVENUE, BROOKLYN—A BAD COBBLE PAVEMENT.

pavements as in this country. The early Roman roads were made of large, irregular stones, laid in mortar, so as to form solid masonry. The natural development was to make the blocks more even, but still of large size. Illustration No. 3 shows a street paved in Pompeii with large stones. As this city was destroyed in the first century of the Christian era, it is probably an example of the oldest pavement on record; while No. 4 shows a modern pavement of Naples, Italy. This gives one a very good idea of a street of this character, and is seldom seen now anywhere out of Italy.

These large blocks did not give satisfaction. They were liable to become loose under traffic, to be slippery and dangerous, so that they were soon given up for streets where the traffic was considerable. The blocks were then made smaller by degrees, so that at the present time 4-inch cubes are used in some English cities, and the London specifications provide for a block from 5 to 12 inches long, 9 to 9½ inches deep, and not more than 3 inches thick. Most American cities, however, specify for granite blocks the following dimensions: Length, 8 to 12 inches; depth, 7 to 8 inches, and width 3½ to 4½ inches; or slight variations from the above. The greater the uniformity that is required in blocks the more expensive it is to produce them, and while it is important that there should not be too great variation in size, undue strictness in this respect should not be required.

There are certain principles that govern these dimensions: (1) Length, if a block be too long it is liable to have an uneven bearing, and consequently be displaced under traffic; while if too short, it will give too many longitudinal joints, and so wear round and uneven; (2) Width, if too wide, blocks become smooth and do not give a good foothold for horses. The surface of ordinary granite will not offer much resistance to horse shoes, so the blocks must be of such a width that the horse can maintain his foothold at the joints, and a maximum width should be a little less than the distance between the toe and heel calks; and if too thin, the edges round off soon, making a rough pavement; (3) Depth, any surface subject to wear becomes rough after much usage; as no material is so uniform in character as to wear evenly, especially when subjected to such an uneven load as street traffic. When it is determined what that depth of wear is, any extra depth over and above what is necessary to render the material (in this case the blocks) stable is wasted. A safe rule is, that no block of less depth than its width will be solid, and in actual practice one not less than one and one-half its depth would be preferable. Experience in American cities has demonstrated that the dimensions given above best accord with these principles.

In selecting the granite for a pavement it does not always follow that the hardest is the most suitable. It depends upon the traffic. Blocks wear in two ways—by a gradual rounding off of the corners and edges, and the general wear over the whole surface. A hard block wears round and a soft one smooth and flat. If the traffic be moderately light, a softer granite will be satisfactory, but for a street subject to heavy and continuous loads the harder varieties must be selected. The harder any stone is the more slippery it becomes under wear. This fact disqualifies many an otherwise good paving stone. Illustration No. 5 shows one of the eastern approaches to the Brooklyn bridge, and is a good representation of the wear of a hard granite. When the trolley tracks were laid on the bridge the traffic was concentrated, with the result shown. The pavement was opened to travel in 1883, and since that time has probably been subjected to as much wear per foot of roadway as any pavement in the country. It was most carefully laid with the best of material, and must be considered a first-class example of its kind.

Granite blocks are laid upon sand and concrete foundations. Where the travel is comparatively light, and a cheap pavement is required, the former method is very satisfactory. It must, however, be well laid. The sub-grade must be thoroughly compacted by a steam roller; all soft or spongy places being dug out and replaced with gravel. The load coming

NO. 3.—STREET IN POMPEII.

CHIEF EDWARD F. CROKER, OF THE NEW YORK FIRE DEPARTMENT.

SUPPLEMENT OF THE MUNICIPAL JOURNAL AND ENGINEER, NEW YORK, APRIL, 1901.

Supplement No. 2, of the Municipal Jo

Population and Water Works Data of C

Compiled by Dudley E. Waters, President Board of Pub

CITY.	Population.	No. of Pumping Stations.	No of Pumps.	Daily Capacity of Stations in Gallons.	Stand-Pipes. No.	Stand-Pipes. Capacity.	Reservoirs. No.	Reservoirs. Capacity.	No. of Meters in Use.	No. of Taps.	Percentage of Meters to Taps.	Average No. of Gallons of Water Pumped Daily.	No. of Gallons per Capita.	No. of Gallons per Tap.
ALBANY, N. Y.	94,151	3	7	61,000,000			10	227,100,000	2,000	17,000	.117	14,000,000	149	824
ALLEGHENY, PA.	129,896	4	15	80,000,000	†6	1,440,000	1	7,000,000	50			36,000,000	277	
ATLANTA, GA.	89,872	2	4	20,000,000			1	176,000,000	10,000	9,050		5,443,581	61	601
BALTIMORE, MD	508,957	3	6	62,000,000	1	300,000	7	971,000,000	1,844	98,596	.018	40,000,000	79	406
BOSTON, MASS.	560,892								4,618	105,565	.043			
BRIDGEPORT, CONN.	70,996	1	2	14,000,000		None	10	2,400,000,000	200	8,000	.025	6,000,000	84	750
BUFFALO, N. Y.	352,387	1	9	200,000,000		None	1	116,000,000	1,500	60,000	.025	110,000,000	312	1,833
CAMBRIDGE, MASS.	91,886	1	4	32,250,000		None	4	2,270,000,000	619	14,049	.044	7,897,453	86	562
CHICAGO, ILL.	1,698,575	10	36	528,375,000		None		None	6,396	200,000	.032	322,599,630	189.8	1,613
CINCINNATI, O.	325,902	5	10	91,000,000	2	153,750	3	107,880,000	2,900	37,000	.078	39,000,000	110	1,054
CLEVELAND, O.	381,768	2	9	108,000,000	1		2	115,000,000	2,617	61,113	.042	61,712,984	162	1,009
COLUMBUS, O.	125,560	2	5	49,000,000		None		None	5,000	14,300	.349	21,000,000	167	1,468
DAYTON, O.	85,333	1	3	39,000,000		None		None	5,200	11,784	.441	6,000,000	70	509
DETROIT, MICH.	285,704	1	4	105,000,000	1	Not in use			5,555	55,340	.100	44,789,213	157	809
DULUTH, MINN.	52,969	1	2	10,000,000		None	2	13,500,000	1,100	3,000	.366	4,200,000	79	1,400
ERIE, PA.	52,733	1	5	25,000,000	1	33,775	1	34,000,000	266	11,163	.023	7,458,418	141	669
FALL RIVER, MASS.	104,863	1	3	18,000,000	2	11,914	3	3,916,577	6,363	6,783	.938	3,580,895	34	528
GRAND RAPIDS, MICH.	87,565	1	4	29,500,000	1	300,000	1	5,000,000	1,193	10,660	.111	13,693,499	156	1,284
HARTFORD, CONN.	79,850	1	4	8,000,000		None	6	2,100,000,000	1,000	9,000	.111			
INDIANAPOLIS, IND.	169,164	2	15	57,000,000		None	1	4,000,000	505	9,943	.050	16,000,000	95	1,609
JERSEY CITY, N. J.	206,433	1	3	9,000,000	1		2	130,000,000	500	25,000	.020	30,000,000	145	1,200
LINCOLN, NEB.	40,169	3	4	5,200,000	2	455,750		None	1,700	3,754	.452	2,000,000	50	533
LOS ANGELES, CAL.	102,479	2	4	13,000,000		None	5	62,100,000	400	21,000	.019	13,500,000	132	642
LOUISVILLE, KY.	204,731	2	5	32,000,000	1		2	110,000,000	1,724	21,400	.080	16,000,000	78	747
MEMPHIS, TENN.	102,320	1	3	30,000,000	1			None	800	9,000	.088	12,000,000	117	1,333
MILWAUKEE, WIS.	285,315	2	7	63,000,000	2	212,000	1	21,000,000	27,480	40,059	.680	25,000,000	88	624
MINNEAPOLIS, MINN.	202,718	3	9	67,000,000		None	2	141,542,030	4,341	18,687	.226	18,862,448	93	1,009
NASHVILLE, TENN.	80,865	1	3	30,000,000		None	1	51,000,000	3,000			13,000,000	161	
NEWARK, N. J.	246,070	2	*	Grav. Sys.		None	7	9,234,000,000	9,400	33,000	.284	26,200,000	106	794
NEW BEDFORD, MASS.	62,442	2	5	34,000,000			1	68,000,000	1,400	9,151	.152	6,200,000	99	678
NEW HAVEN, CONN.	108,027	3	3	20,000,000		None			325	14,000	.023	15,000,000	138	1,071
NEW ORLEANS, LA.	287,104	1	3	47,000,000	1	65,424	1	4,000,000	191	5,200	.036	10,000,000	35	1,923
OMAHA, NEB.	102,555	4	12	123,000,000		None	11	130,000,000	3,800			20,000,000	195	
PHILADELPHIA, PA.	1,293,697	11	47	438,540,000	3	318,000	11	1,417,860,000	1,615	243,644	.006	295,866,771	229	1,214
PITTSBURG, PA.	321,616	4	6	87,500,000		None	3	124,500,000	210	32,309	.006	54,000,000	168	1,671
PORTLAND, ORE.	90,426	2	5	24,000,000		None	4	65,000,000	525	12,477	.042	16,000,000	177	1,281
PROVIDENCE, R. I.	175,597	2	6	44,000,000	1	61,300	3	152,000,000	17,124	21,020	.814	11,560,987	66	549
READING, PA.	78,961	1	2	15,000,000		None	6	181,532,000	636	15,885	.040	2,161,000	27	136
RICHMOND, VA.	85,050	3	18	24,000,000			2	55,000,000	4,300	14,700	.292	10,000,000	118	680
ROCHESTER, N. Y.	162,608	1	5	31,000,000		None	2	86,000,000	8,020	34,035	.235	1,300,000	80	382
SEATTLE, WASH.	85,000	3	4	11,000,000	1	300,000	1	450,000	775	5,543	.111	7,256,399	85	1,319
SOMERVILLE, MASS.	61,643	*	*	Grav. Sys.		None		None	226	10,053	.022			
SPRINGFIELD, MASS.	62,059	*	*	Grav. Sys.		None	1	2,295,792,000	2,765	9,456	.292	5,307,000	86	
ST. LOUIS, MO.	575,238	4	11	100,000,000	3		1	67,000,000	4,133	65,688	.062	80,000,000	139	1,217
ST. PAUL, MINN.	163,065	5	7	20,000,000	1	100,000	1	18,000,000	4,600	18,600	.247	8,300,000	51	445
SYRACUSE, N. Y.	108,374	*	*	Grav. Sys.		None	1	121,000,000	7,836	18,005	.435			
TOLEDO, O.	131,822	1	5	45,000,000	1	33,000		None	5,500	12,500	.440	7,750,000	59	620
TROY, N. Y.	60,651	1	2	12,000,000		None	6	285,000,000	309	7,413	.041	9,110,342	150	1,228
WASHINGTON, D. C.	278,718	1	3	18,000,000		None	5		1,135	44,654	.025	6,874,222	24.6	154
WILMINGTON, DEL.	76,508	2	5	45,000,000	3	550,000	2	41,500,000	650	15,000	.043	6,683,562	87	445
WORCESTER, MASS.	118,421	*				None	3	1,600,000,000	12,235	12,996	.941	7,500,000	63	577

* No pumps, or none used. †Tanks. ** Barrels of oil. ††Water power and sawdust.

2, of the Municipal Journal

Population and Water Works Data of Cities of 50,0

ed by Dudley E. Waters, President Board of Public Works, G

Stand-Pipes. No.	Stand-Pipes. Capacity.	Reservoirs. No.	Reservoirs. Capacity.	No. of Meters in Use.	No. of Taps.	Percentage of Meters to Taps.	Average No. of Gallons of Water Pumped Daily.	No. of Gallons per Capita.	No. of Gallons per Tap.	Miles of Mains in System.	Daily Consumption of Coal, in Tons.	Average Price per Ton.	
		10	227,100,000	2,000	17,000	.117	14,000,000	149	824	130	10	$4.	$1
†6	1,440,000	1	7,000,000	50			36,000,000	277			155	1.50	8
		1	176,000,000	10,000	9,050		5,443,581	61	601	108	17	1.87	1
1	300,000	7	971,000,000	1,844	98,596	.018	40,000,000	79	406	550	27½	2.64	2
				4,618	105,565	.043				706			
	None	10	2,400,000,000	200	8,000	.025	6,000,000	84	750	110	2½	3.60	
	None	1	116,000,000	1,500	60,000	.025	110,000,000	312	1,833	500	125	1.33	6
	None	4	2,270,000,000	619	14,049	.044	7,897,453	86	562	121	48	4.23	
	None		None	6,396	200,000	.032	322,599,630	189.8	1,613	1,8/2	261	3.39	33
2	153,750	3	107,880,000	2,900	37,000	.078	39,000,000	110	1,054	386	155.2	1.1o	6
1		2	115,000,000	2,617	61,113	.042	61,712,984	162	1,009	531	120	2.09	9
	None		None	5,000	14,300	.349	21,000,000	167	1,468	184	26	1.65	1
	None		None	5,200	11,784	.441	6,000,000	70	509	117	7½	2.	
1	Not in use			5,555	55,340	.100	44,789,213	157	809	560	22	2.24	1
	None	2	13,500,000	1,100	3,000	.366	4,200,000	79	1,400	60	8	2.20	
1	33,775	1	34,000,000	266	11,163	.023	7,458,418	141	669	103	8	1.65	
2	11,914	3	3,916,577	6,363	6,783	.938	3,580,895	34	528	86	5	3.	
1	300,000	1	5,000,000	1,193	10,660	.111	13,693,499	156	1,284	141.6	18	3.	1
	None	6	2,100,000,000	1,000	9,000	.111				120			
	None	1	4,000,000	505	9,943	.050	16,000,000	95	1,609	213			
1		2	130,000,000	500	25,000	.020	30,000,000	145	1,200	220	5	2.75	
2	455,750		None	1,700	3,754	.452	2,000,000	50	533	60	25	2.95	2
	None	5	62,100,000	400	21,000	.019	13,500,000	132	642	330	**25	1.00	
1		2	110,000,000	1,724	21,400	.080	16,000,000	78	747	221		2.65	
1			None	800	9,000	.088	12,000,000	117	1,333	120	12		
2	212,000	1	21,000,000	27,480	40,059	.680	25,000,000	88	624	341	15	2.96	1
	None	2	141,542,030	4,341	18,687	.226	18,862,448	93	1,009	263	††	††	2
	None	1	51,000,000	3,000			13,000,000	151		75	30	2.15	2
	None	7	9,234,000,000	9,400	33,000	.284	26,200,000	106	794	247			
		1	68,000,000	1,400	9,151	.152	6,200,000	99	678	91	4	3.75	
	None			325	14,000	.023	15,000,000	138	1,071	162	7	3.50	
1	65,424	1	4,000,000	191	5,200	.036	10,000,000	35	1,923	124.5	8	3.19	9
	None	11	130,000,000	3,800			20,000,000	195		220	50	2.	3
3	318,000	11	1,417,860,000	1,615	243,644	.006	295,866,771	229	1,214	1,303	473	2.38	41
	None	3	124,500,000	210	32,309	.006	54,000,000	158	1,671	323	103	1.37	5
	None	4	65,000,000	525	12,477	.042	16,000,000	177	1,281	125	30 Cds.	3.50	3
1	61,300	3	152,000,000	17,124	21,020	.814	11,560,987	56	549	318	8	3.98	1
	None	6	181,532,000	636	15,885	.040	2,161,000	27	136	100	3	2.60	
		2	55,000,000	4,300	14,700	.292	10,000,000	118	680	94			
	None	2	86,000,000	8,020	34,035	.235	1,300,000	30	382	322	5	2.63	
1	300,000	1	450,000	775	5,543	.111	7,256,399	85	1,319	113	29.65	1.65	1
	None		None	226	10,053	.022				81			
	None	1	2,295,792,000	2,765	9,456	.292	5,307,000	86		143			
3		1	67,000,000	4,133	65,688	.062	80,000,000	139	1,217	616	136	1.17	5
1	100,000	1	18,000,000	4,600	18,600	.247	8,300,000	51	445	246		4.10	
	None	1	121,000,000	7,836	18,005	.435				161			
1	33,000		None	5,500	12,500	.440	7,750,000	59	620	160	11.9	1.11	
	None	6	285,000,000	309	7,413	.041	9,110,342	60	1,228	61	8.2	2.44	
	None	5		1,135	44,654	.025	6,874,222	24.6	154	242	8	3.00	
3	550,000	2	41,500,000	650	15,000	.043	6,683,562	87	445	100	6	2.20	
	None	3	1,600,000,000	12,235	12,996	.941	7,500,000	63	577	170			

r power and sawdust.

l and Engineer, April, 1901

),000 or More.

Grand Rapids, Michigan, 1901.

Annual Cost of Coal.	Cost of Water Works to Date.	Annual Receipts.	Annual Expenses, Pumping, Maintenance and Collections.	Compensation for City Parks.	Compensation for Cemeteries.	Compensation for Public Places.
$14,600.00	$3,520,000.00	$280,000.00	$85,500.00	None	None	None
84,862.50		336,729.00	180,242.71	None	Paid for	None
11,603.35	3,280,000.00	116,302.66	48,434.31	None	None	None
26,499.00	10,285,400.00	890,000.00	222,000.00	None	None	None
	22,689,783.75	2,289,739.50	571,075.93	None	None	None
3,286.80						
60,681.25	9,000,000.00	700,000.00	125,000.00	Rate of 2 cents per 1,000 gallons		
7,409.00	5,649,015.65	313,549.10	49,418.41	None	None	None
332,948.35	33,364,032.19	3,248,411.36	1,195,907.42	None	None	None
65,710.95	15,000,000.00	764,203.55	393,982.78	None	None	None
91,542.00	9,518,480.46	725,640.32	171,008.86	None	None	None
15,658.50	2,502,510.15	151,826.29	68,715.52	Paid	Do not use	Paid
5,475.00	816,000.00	82,967.25	32,440.41	Water works furnishes $75,000 free water		
17,987.20	6,061,110.27	303,910.42	194,425.82			
6,424.00	1,717,112.00	130,000.00	26,000.00	Meter rates	Meter rates	Meter rates
4,633.06	1,716,015.42	139,344.02	32,144.22	Regular rates charged on books		
5,475.00	1,914,968.25	160,362.07	35,484.00			
19,710.00	1,432,087.23	125,946.20	48,653.07	None	$500 in 1900	Meter rates
	2,906,000.00	253,988.40		Meter & fixed rates		$60—water trough
	3,500,000.00	309,960.88				
5,018.75	5,000,000.00	900,000.00	585,000.00	None	Paid	None
26,918.75	369,572.00	40,900.00	22,023.17	None	Do not use	None
9,125.00		253,476.04	75,104.99	None	Private—paid	None
	5,600,000.00	347,114.31		6c. per 1,000 gal.	Meter rates	
	2,400,000.00			$3,000 for all parks and public places		
16,206.00	4,962,793.48	458,299.82	144,953.84	Meter rates	Meter rates	Meter rates
27,162.27	4,342,052.67	207,389.76	127,549.68	4c. per 1,000 gal.	8c. per 1,000 gal.	
23,542.50	1,500,000.00	137,500.00	50,500.00			
	9,500,000.00	625,000.00	108,000.00	By meters, less than $5,000.		
5,475.00	1,800,301.78	117,771.87	140,775.06			
8,942.50						
9,312.42		253,476.04				
36,500.00	6,000,000.00			None		C'y H'l & J'l, meters.
410,895.10	35,500,000.00	3,123,954.20	934,090.64			
51,505.15	6,678,118.37	800,000.00	212,860.81	None	None	None
38,325.00	3,950,309.23	264,269.65	39,964.00	None	None	None
11,621.60	6,435,568.24	522,124.46	49,279.49	One-half rates	One-half rates	One-half rates
2,847.00	1,838,659.76	161,077.20	22,809.54	None	Private—meter	Schools pay
	2,300,000.00	142,000.00	34,000.00	None	None	None
4,499.75	6,773,748.00	390,000.00	53,621.86	None	None	None
17,846.71	1,300,000.00	163,084.77	32,561.91			Fixed rates
	741,557.57	214,280.83	33,567.18	None	None	None
3,359.73	2,115,576.49	235,050.00	358,169.85	Same as fire	Private	Same as fire
58,078.80	20,000,000.00	1,500,000.00	547,896.62	None	Private	None
	4,000,000.00	185,000.00	42,922.82	Regular rates	Regular rates	Regular rates
	4,200,000.00	225,000.00	42,853.00			
4,821.29	1,850,000.00	133,176.64	40,932.93	None	None	None
7,300.00	1,300,019.40	104,689.82	35,000.00	None	None	None
8,760.00	1,500,000.00		63,000.00	None	Paid	None
4,818.00	1,650,000.00	165,000.00	40,864.00	None	None	None
	3,250,000.00	250,000.00	43,317.46	None	$132.40 in '99	None

NO. 4.—STREET IN NAPLES.

upon the individual blocks is transmitted to the ground with almost no spreading, and if the base be yielding the surface of the pavement soon becomes rough and uneven, which causes abnormal wear. When the sub-grade has been prepared as above, some four or five inches of sand should be spread over it, upon which the blocks are to be laid. They should be laid in courses at right angles to the curb, as closely together as possible. Even when the blocks are laid stone to stone, when the final ramming has been done the joints will be larger than would seem possible. Care must be taken to break joints with a lap of at least three inches. While this seems simple, many pavers require constant watching to prevent its occurrence. Another important feature is the ramming. As soon as the pavement is laid the joints should be filled with sand and the blocks thoroughly rammed. This process settles the sand, when the joints should be refilled and the entire pavement re-rammed. All blocks should be rammed to a solid bed, any irregularities being corrected by taking up the low blocks and raising the foundation with sand. All uneven blocks should be trued up and the corners straightened so as to present a regular appearance.

If the above precautions are taken, a good pavement can be obtained, if the natural soil be firm and unyielding. Illustration No. 6 shows a portion of Clinton street, in Brooklyn, laid in this manner more than twenty years ago. When, however, a pavement is to be subjected to a heavy traffic, and it is wholly a question of absolute wear, the blocks should be laid upon a concrete base and the joints filled with an impervious material. The concrete should be six inches thick, mixed in the proportions of 1-2-4 if natural cement is used, and 1-3-6 if made of Portland cement. Enough sand should be spread over the concrete to give all blocks a cushion of at least one inch when rammed. The filling for the joints has received considerable attention, and the present practice is to use a grout made of equal parts of Portland cement and sand, or gravel, with its interstices filled with coal tar pitch. The latter method is much more generally used than the former. The object of the filler is to get a tight joint, and the gravel should be of such size as to have as few and small voids as possible and still allow the pitch to surely fill all interstices. It is generally required to be of a size that will pass through a sieve of ¾-inch meshes and be retained by one of ¼-inch, being evenly graded between the two. Pure coal tar pitch does not give good results for filling joints; it is apt to be too brittle in cold weather and too sticky in warm. It is, therefore, fluxed by adding to each 100 pounds of pitch 20 pounds of refined asphalt and 3 pounds of residium oil. This gives a satisfactory mixture for the vicinity of New York. The method of laying is practically the same as when laid on sand, except as regards the joints. These should be laid about ¾-inch wide, so that they can be filled with the gravel. After the blocks are laid the joints should be filled to within three inches of the top with gravel and the entire pavement rammed and re-rammed as above. The joints should then be poured to the top of the gravel with the pitch, which is allowed to settle off into all the joints and interstices, when they should be filled with gravel and again poured with pitch until the joints remain full flush with the top of the pavement. If necessary, more gravel should be added and tamped into the joints. The gravel should be at a temperature of 250° F., and the pitch at 300° F., when used. Illustration No. 7 shows a view of Fulton street, Brooklyn, paved in this way in 1895.

Another form of stone pavement which has been in use in New York and neighboring cities is that known as the Belgian block. The block is really a truncated pyramid, and is a modified form of the cubical block of Europe. It was first laid in this country about 1850, and for some time was the prevailing improved stone pavement of New York. The specifications called that the blocks should be of the following dimensions: Length, from 6 to 8 inches; width, from 4 to

NO. 5.—APPROACH TO BROOKLYN BRIDGE—LAID IN 1883.

NO. 6.—CLINTON STREET, BROOKLYN—PAVED ABOUT 1877.

6 inches, and depth, from 6 to 8 inches. It was also provided that the base of the blocks should not be more than one inch less in length and width than on top, and all blocks 4 inches wide on top should have the same width on the base. So much variation in size made it very difficult to get good results with these blocks, especially, as was almost always the case, when made of the trap rock so plentiful on the Hudson river. This rock is very hard and durable, but wears smooth and slippery under traffic, so that with blocks of the shape described the pavement became quite unsatisfactory. It was displaced by the oblong granite block, and at the present time is not very often laid. Illustration No. 8 shows a portion of the plaza at the entrance of Prospect Park, Brooklyn, and it is probably as good an example of this pavement as can be found in this vicinity.

Trap rock is sometimes made into blocks of the same dimensions as those given for granite, when it is called "specification Belgian." This term is wrong, as "Belgian" refers to shape entirely and not to material. Blocks of this kind make a durable pavement, but as the trap rock does not break readily into this shape they are expensive and have never been used to any great extent.

NO. 8.—PROSPECT PARK PLAZA, BROOKLYN—GOOD TYPE OF BELGIAN PAVEMENT.

Another distinct type of stone pavement is that known as Medina block. This is used principally in the cities of Cleveland, Buffalo and Rochester. Medina stone is a hard sandstone found in Western New York, generally of a red or gray color. It is harl and sufficiently stratified to allow it to be easily made into blocks. It makes a first-class paving material, as it resists traffic well and is of such a nature that the blocks wear flat, so that the pavement is smoother after it has been in use for some time than when it is first laid. It is durable, comparing favorably in this respect with the softer granites. The same principles govern the size of blocks as with granite, except the width. Being of a gritty character, it presents friction to horses' feet, and so the blocks can be made wider, the horse not depending so much upon the joints for a foothold. It is deservedly popular wherever used, but the transportation charges prevent its adoption in many large cities, except as noted.

Being a stratified rock, the blocks can be laid close or with open joints, which in either case are filled with an impervious

NO. 7.—FULTON STREET, BROOKLYN, NEAR CITY HALL—PAVED 1895.

material. In Cleveland, the blocks range from 3¼ to 5 inches in width, but are divided into three classes: (1) 3¼ to 3½ inches; (2) 3¾ to 4¼ inches; (3) 4½ to 5 inches. The blocks are separated upon delivery and laid in the work, each class by itself. The courses are driven close together, and after being rammed the joints are filled with pitch, Portland cement grout, or any other filler that may be designated. In Rochester the blocks are laid with a ½-inch joint, which is filled with a fine gravel and then poured with pitch in about the same manner as with granite.

The life of a stone pavement depends wholly upon the traffic it sustains. From the money standpoint it is undoubtedly the most economical for that reason. Estimates vary considerably in this respect; but, in general, is about as follows:

Granite block on sand, 20 years.

Granite block on concrete, 25 years.

Medina sandstone on concrete, 20 years.

During this period, the cost of repairs will be practically nothing, except in some cases the cost of relaying.

WHY I BELIEVE IN MUNICIPAL OWNERSHIP.

BY WILLIS J. ABBOT.

If a man possessing an estate of incalculable value which, with ordinarily capable business management, would produce for him an annual revenue far in excess of any that our greatest millionaires now enjoy, should permit himself to be taken into a back room, and by fair words, cajolery and blandishments, always at the command of the unprincipled, be bamboozled into giving up for a trivial annual sum the control over his own estate, he would probably be held up to scorn by all sound business men. His banker would look askance at him as he passed upon the street, and his name would be a synonym for folly in all the houses where his action was known.

Now, what is true of one man ought to be true of great associations of men. The principle which I have laid down is admittedly applicable to stock companies, but when we come to apply it to great municipalities, which are really stock companies, then your "sound business man" cries "socialism," and seems to think that the right and proper thing for the municipality is to throw away its heritage and take such a portion of its income as the people who acquire it may see fit to give. Fifty years of this sort of thing has made it possible to put on the defensive those who believe that the people should do as they will with their own and use it for their own benefit.

We are asked to defend municipal ownership as though it were something unnatural, an artificial development of new conditions rather than, as it is, the one natural and the one reasonable course for men living in the co-partnership of a municipality to adopt.

I believe in municipal ownership partly because it is natural. The streets belong to the city, and the city should utilize them in order to get for its citizens the greatest possible advantages and for the public treasury the largest reasonable sums. I put the treasury second, because it seems to me that with the present system of land holding so many of the advantages derived from what we call public utilities, notably the advantages which come from street railroads, accrue to the owner of the land that it is not so necessary to reduce taxation by drawing into the city treasury the revenues now enjoyed by the private corporations, as it is to reduce the involuntary taxation which the non-land owning citizen has to pay when he gives his nickel to the conductor, or by payment to the gas company attests a grudging belief in the accuracy of his gas meter.

The public utilities which now come under the head of things which should be owned and managed by the municipalities are transportation, lighting and the water service. In time these will be immensely increased. The streets of some cities are used to convey heat, the revenues going to private companies. In others they are used to convey power, private individuals again enjoying the fruits. But every enterprise, which is dependent for its success upon the right to use, to the complete, or almost complete exclusion of all others, the streets of a city is naturally a monopoly, and should be owned and managed by the city.

We have in fact begun to recognize the fact that private ownership of these natural utilities is artificial, illogical and indefensible. There is no one who will admit that any corporation should be given the right to use the streets for its own profit without conceding to the representatives of the people some control over its action. There is no party in favor of unregulated private ownership. The only two parties dealing with municipal affairs are those who believe in municipal control and those who believe in municipal ownership and operation. Private ownership is dead even among the beneficiaries of the present system.

The system of municipal control has failed everywhere. It is in operation practically in all our cities, and its failure is as universal as its existence. It is responsible for nine-tenths of the corruption in our municipal politics—corruption which is the amazement of all civilized people. When you urge the complete municipal ownership and operation of public utilities you are met at once by the questions "Would you put the control of our street railroads in the hands of the average board of aldermen? Would you have the gas company in politics? Would you multiply a hundredfold the people who draw their salaries at the city treasurer's office, and who would hold their places at the pleasure of a partisan mayor?" These questions touch a weak point of municipal ownership, I admit, but do not cover up the still weaker points of mere municipal control, which are inherent and cannot be cured. Every great corporation using the streets of the city for gas mains, for tramways, or other utilities of that sort, is in politics. Within my knowledge the time has been when the employees of a certain great street railroad system in New York City were apportioned between two great political organizations. In Chicago within a few years a newly nominated mayor rushed hastily from the platform on which he stood to accept the nomination just given him, sprang into a carriage, and went first of all to the house of the man who at that time controlled four-fifths of the street railways of that city. In the same city I have known a "street railway magnate," as the phrase goes, to contribute a sum exceeding $60,000 merely for the purpose of fostering an independent candidacy by which a mayor who had been hostile to him and his interests might be beaten. I doubt if any New Yorker will question the fact that both the street railways and the elevated roads have been potent factors in politics. Now, under this system of control the private corporations have too easy methods for debauching American municipal government, and thereby in the end make our national politics almost as bad, for more and more the control of the great cities is coming to mean the control of the Presidential election. The development and perfection of the science of stock watering, juggling securities, and combining to wreck the markets has made managers of these roads less dependent upon the profits for their income than upon their skill in working the stock market. A friendly tip to a boss enriches him, and results in getting inestimable privileges in the way of extended lines, new franchises and less rigorous enforcement of control. On the other hand, the unscrupulous aldermen, knowing the real vulnerability of these corporations, is able at any time by forming a company of straw and rushing through an ordinance which seems to threaten competition, to attack them and to secure blackmail. These quasi-public corporations are more than anything else the cause for the

presence in our City Councils of men who are universally admitted to disgrace them. If we took away from the City Council everything it had to sell, we should not find men going there for the purpose of enriching themselves. If we took away from private corporations all incentive to bribe bosses or aldermen because the boss or alderman had nothing to give in return, we should find that there would be no effort to tamper with our municipal law-makers. I sincerely believe that perhaps the greatest advantage that would accrue from municipal ownership throughout the nation would be the purification of municipal politics in America. We can find a certain illustration of that in the history of English cities in the last fifty years. Prior to that era municipal government in England was about as bad as it is to-day in America—one could hardly say worse. Then came the era of great municipal improvements, the era of the tramway, of gas, of distributing water to the houses of the cities, and the Englishman, with his stubborn insistence upon his rights as citizen and ratepayer, instantly declared that he must get all that was due him from the use of his city streets. The result has been that the development of these municipal activities in public works has been the purification of English cities. Their municipal government has improved as rapidly as ours has retrograded, and all the time they have clung stubbornly to the principle that every natural monopoly must remain the property of the city and be managed by it.

But people say, If you had a proper civil service reform system then possibly these Utopian ideas might be put into effect. In my opinion one great reason why we have such a complete lack of any effective civil service in our cities is that nearly everything at which the city government should touch the daily life of the people has been taken away from the government proper and turned over to the private corporation. We can have departments well and efficiently conducted in the worst managed cities to-day if the people demand it, and if they feel that these departments are essential to the safety of their lives and properties they do demand it. The United States navy itself does not afford a finer instance of intelligence, efficiency and *esprit de corps* than the fire department of any American city. Why? Because the people, and particularly the great commercial classes, feel it essential for their well being, for their property and for their very lives, that the department which is to guard them against fire should be managed with the very highest intelligence. Given the street railway under a like management, and the citizens would insist upon like efficiency, because virtually all use it several times daily. We find another illustration by turning to the national government. If the Post Office Department had been, as it easily might have been, a private enterprise, it is doubtful whether civil service reform would have made any headway. It has had its beginnings in the Post Office Department, and has its highest manifestations there because the carriage of the mails is a matter of importance to every citizen of the land; business could not afford the effect of the turning out every four years of the trained clerks in Washington and in the larger cities.

I believe that if the street railways of New York City were owned and managed by the city, the people would compel as much efficiency in their management as they do in that of the fire department now. In all the larger cities of the United States the matter of supplying water for the city is probably regarded as a purely public function. The people of New York, indeed, were aroused to a fever of indignation recently by the effort on the part of a few politicians and capitalists to secure, not the water system, but the land comprising the water shed from which alone a sufficeint supply of water for the estimated needs of the city for the next twenty years could be obtained. The outcry caused by the so-called "Ramapo job" afforded a fair indication of the strength of the municipal idea in New York. All men saw that it was intolerable that the water supply of the city should be in the command of a few men. All who saw that ought equally to be able to see that it is intolerable that the supply of light for the city after the daylight has left is monopolized by a private corporation. And they ought to, and I think do understand that it is quite as easy for the city to make gas and to send it through pipes as it is for it to store up water and distribute that through pipes. With the increasing use of electricity we may expect to find the demand on the streets for the purpose of distributing that fluid vastly enhanced. In time, no doubt, the American city will go into the business of supplying electricity, not merely for light, but for power and heat as well. Probably before that time comes the valuable franchises for that purpose will have been given to some private corporations, and our municipalities have to buy them back dearly. For the American people enforce upon themselves a sense of honor which they do not seem to ask of those who have robbed them. If they have been robbed of a franchise through open and notorious bribery they never will consider a method of getting it back except by honest purchase. When Jake Sharp was convicted of wholesale bribery in the Broadway Cable Line case, he went to the penitentiary, but his associates still held the franchise. The people of New York had the advantage of seeing a man punished for stealing their goods, but did not get the goods back, although they knew in whose possession they were.

Beyond doubt throughout the United States the trend of popular sentiment is toward public ownership. The only argument in the way of its immediate adoption is the execrable condition of our present municipal governments. Professor Frank Parsons has very justly pointed out that in order to have public ownership you must have public government—that it is not quite just for us to compare the probable conditions of public ownership here with those existing in, let us say, Russia, where they have in the city of St. Petersburg the street railroads under government control. They have not public ownership there; they have government ownership. Here we want public ownership, but the public ought to own our city governments before we can make it a complete success. At present the public does not own our governments. The very corporations controlling the valuable franchises we are seeking to regain make our mayors and aldermen maintain them and control them, and then ask sneeringly, "Will you take great enterprises out of our hands to deliver to men like these?" Our long experiment in municipal control of corporations has only ended in the corporation control of our municipalities. But what is the solution of this difficulty? Is it to wait until we have

brought our municipal governments up to the highest point of purity and efficiency, having meanwhile to fight at every step the influence of the corporations, or it is not rather to take advantage of the first opportunity that may come, and it may come at any moment, to weaken the corporations by ousting them one by one and reforming our municipalities as fast as the malign corporate influence will permit us or is destroyed? Probably the latter course would prove that of expediency. Within four years Chicago narrowly escaped electing a real municipal ownership Mayor and Council. It failed because the corporations threw all their influence on the side of a man in whom they had faith. But the narrowness of that failure gives good reason to hope that with the growing discontent with existing conditions there the time is near at hand when there may be a municipal government which for two years at least will have the capacity and the willingness to attack the corporations with vigor and intelligence. Such an administration could find a way to begin the work of municipal ownership, and with every step taken the cause will be stronger, its foes weaker. Out of it all will come a higher ideal of city politics, a material reduction in the daily expenses of the citizen, an increase in revenues derived by the city other than through direct taxation, and if we must admit it, much less business for the brokers on the various stock exchanges, for there would be withdrawn from circulation many hundred millions of stocks now floating in water deep enough for a battleship to swim in.

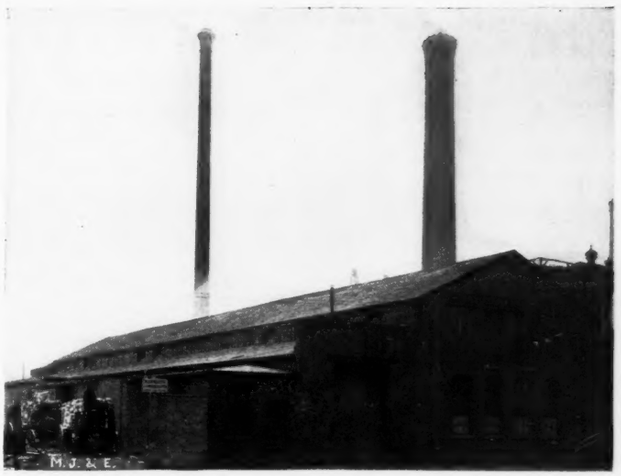
These are not all the reasons why I believe in municipal ownership, but I have laid stress on two—namely, natural justice, and the effect on city government because others have been inclined rather to emphasize the purely economic phases of the question. I believe further, that by it city revenues would be increased, taxation lightened, funds for public improvements established, and every service now performed by stock-watered corporations be more cheaply and efficiently rendered.

UTILIZING BOSTON'S REFUSE.

BY W. F. MORSE, SANITARY ENGINEER, NEW YORK.

THE component parts of municipal waste in any large city may be roughly stated as garbage, 17 per cent.; combustible refuse, 10 per cent.; ashes, 73 per cent. These proportions change according to conditions which need not be now discussed; but, in the main the relative quantities will not greatly vary. Of these parts, the garbage is disposed of in various ways—the ashes used for filling low grounds, or carried to sea, and the combustible refuse is usually collected and dumped with the ashes as worthless.

The experiments made in 1896 by the late Col. Geo. E. Waring, while street cleaning commissioner of New York, showed that if separately colllected there was a value in refuse or rubbish which would more than repay the cost of collection, separation and special treatment. The refuse disposal station built by Col. Waring in 1897 is not now in operation, and New York City has reverted to its former methods in use before his advent, but Waring's ideas for the separate treatment of refuse were taken up and carried out in another city with remarkable success.



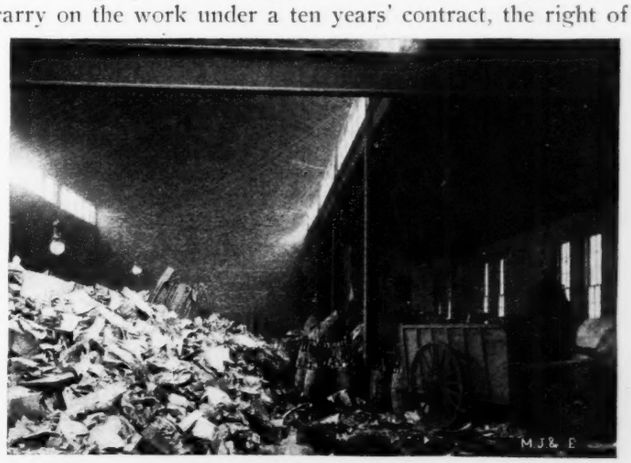
BOSTON REFUSE DESTRUCTOR STATION.

Prior to the year 1898 the city of Boston towed to sea its ashes and refuse. The garbage had for years been separately collected and sold as food for swine, the returns for several years from this being upwards of $20,000. Since 1898 it has been taken by the Sanitary Product Company and manufactured into commercial products by extraction of the grease.

But the refuse and rubbish always gave trouble, causing endless complaints, from the neighboring towns, whose beaches and shore lines were fouled by the floating and decaying matter.

The Board of Health constantly urged the adoption of some better method, and in April, 1898, the city advertised for methods to cremate this refuse, receiving five proposals, all of which were rejected as impracticable. In September the writer brought to the attention of the Mayor a proposal for the erection of a Refuse Disposal Station which should receive the rubbish from the main part of the city, separate the marketable portions and destroy the residuum, with no offense and without fuel. The plans were approved, and after some delay the plant was begun in November, finished in January, 1899, and has since been in continuous operation.

A company was incorporated to build the plant and carry on the work under a ten years' contract, the right of



RECEIVING ROOM AND COLLECTION CART.

CONVEYOR AND SORTING FLOOR.

purchase at the end of five years being reserved by the city.

All of the refuse (which does not include ashes or garbage) within certain limits—practically a circle of two miles in diameter—is collected by the city and turned over to the company at the station. This is placed near the dumping-board on the water front at Atlantic avenue, half a mile from the City Hall and nearly in the geographical center of the collection district, which includes nearly all the main business district of the city, with a proportion of dwellings and a few factories—having ninety-five miles of streets and about 200,000 inhabitants.

A force of twenty-four carts, each drawn by one horse, attended by one man, does all the work, making a daily collection from the business section; tri-weekly from the resident. There was some difficulty at first to prevent the unauthorized scavengers from picking over the refuse when placed on the street, and the public had to be educated to make the separation of refuse heretofore mixed with the ashes.

The Disposal Station is a building 162 feet long, 80 feet wide, with brick walls and steel columns supporting a wooden roof. There is a sub-basement under one-half of the building containing the baling presses and destructor.

A large storage space is provided for receiving the waste, the carts discharging with no delay except for weighing each load. From this storage space the rubbish, with a little preliminary sorting to remove the heavier articles, is placed on an endless belt or movable iron platform 4 feet wide and 150 feet long, which carries it slowly toward the other end of the building. On each side of this moving conveyor stand files of men who pick out the several grades of paper, rags, cardboard, etc., and place in bins behind them. The bottoms of these bins discharge into presses driven by power placed in the basement which press the paper and rags into bales of 600 pounds. The other articles, glass, iron, leather, twine, etc., are also removed to separate bins.

The portions of refuse remaining on the conveyor not worth saving, pass up an incline and are discharged through a chute in a continuous stream into the Morse-Boulger Refuse Destructor placed across the rear end of the building, everything worthless being burned without delay and with no rehandling or storing. This destructor is of a special and peculiar type, built with interior fire-brick walls of special blocks, with heavy exterior walls solidly bound with backstays and tie-rods, provided with sliding fire-clay cover for the feed holes, and doors for removing clinker and ashes.

At the rear end is a 60 H. P. boiler, with independent fire-box, but operated solely by heat from the destructor, and furnishing power for moving all the machinery for sorting and baling, operating a dynamo for lighting the building by electricity (10 arc lights and 30 incandescent) and heating it in winter. No fuel has ever been used except the refuse, and but a portion (25 H. P.) of the power developed is employed. A boiler of 100 H. P. can be maintained at its maximum capacity by the heat from the destructor. The draught is regulated by heavy fire-clay dampers, the surplus heat going through a by-pass to the chimney—a steel self-supporting shaft 140 feet high lined with fire-brick.

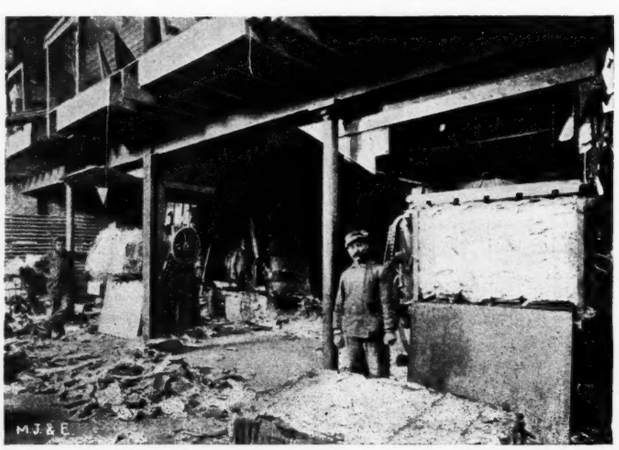
The plant operates from eight to ten hours per day, dependent upon the supply of refuse, and has a capacity of 500 cubic yards in 24 hours.

The total quantity of refuse collected from this Boston district and delivered at the disposal station in 1899 was 16,926 cart loads of 4 cubic yards, weighing 808 pounds per load—equivalent to 7,800 tons. These loads were greatest in number during the summer months—sometimes 90 loads per day—the daily average for the year amounting to 62 loads, equivalent to 25 tons.

The component parts of this collection inclule everything in the shape of miscellaneous refuse and the thousand useless and discarded articles from houses, stores and factories.

A conservative estimate of the relative proportions would be 60 per cent. of the whole as salable; 25 per cent. as burnable for fuel, and 15 per cent. as worthless for any other purpose. Taking the total amount at 7,800 tons for the yearly collection, then 4,680 tons represents the marketable portion; 1,950 tons the combustible part as fuel, and 1,170 tons the worthless matters. The ashes remaining after combustion is about 15 per cent. in weight of the total amount destroyed.

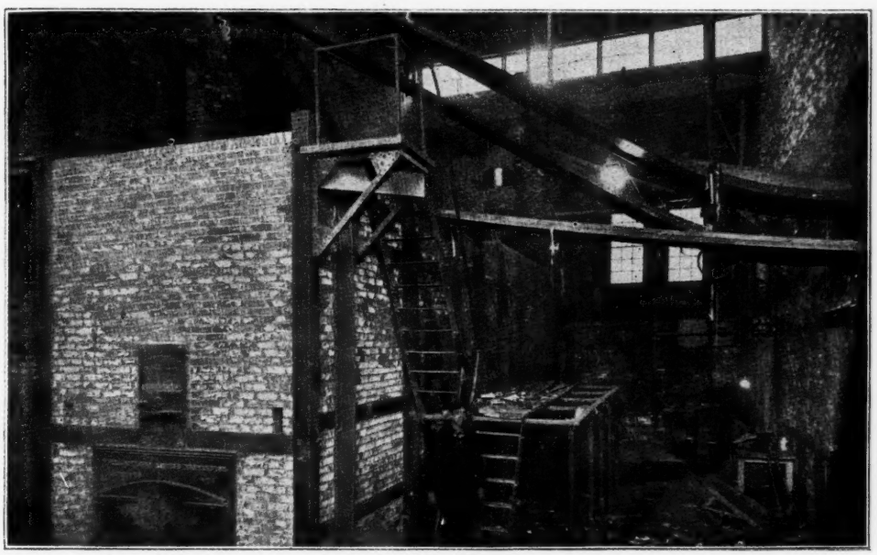
There is no report available of the proportionate quantities of the salable matters, but as this has been arrived at in New York City, if the same standard be used, then the following will show the relative amounts of each 100 parts, as follows:



POWER AND HAND BALING PRESSES.

Paper—six different grades, 74.5 per cent.; rags, clothing, bagging, twine, etc., 12.2 per cent.; carpets—four grades—3.3 per cent.; bottles, 2.5 per cent.; metals, 2.1 per cent.; tins, 1.4 per cent.; leather, 1.9 per cent.; rubber, .2 per cent.; boxes, barrels, wood, etc., 1.4 per cent.; other salable materials, .5 per cent.; total, 100 per cent.

Applying this same scale of measurement to the refuse collection of the whole city, with 500,000 inhabitants, there would be annually collected 19,500 tons of refuse, of which 11,700 tons would represent the marketable portion; 4,875 tons are combustible for fuel, and 2,925 tons are worthless. The actual money value of this refuse, including the saving in transportation of the quantities formerly towed to sea, will approximate $85,000, but not including the value of the surplus steam power developed by the destructor and steam boilers.



MORSE-BOULGER DESTRUCTOR—BOILER, ENGINE AND DYNAMO—BOSTON.

As this was the first station of its kind to be built on so large a scale, there were many problems to be solved and new methods to be invented. The sanitary operation of the plant was an important matter. Because of its situation in the heart of the city, within two blocks of the great Southern Railroad Station, on one of the main business thoroughfares, and on a line of street cars, there could be no offensive odors of the works, or discharge of ashes from the chimney, nor interference with the traffic of the streets and walks.

The basement floor is six feet below the line of high water, and unusual expense was incurred in making this waterproof. Special pains was taken with the construction, to control and make complete the combustion of the refuse and give room and convenient access for the city teams. Some rearrangement of the machinery and interior fittings was needed, but all these points were finally adjusted, and the plant has been doing its work from the day it started with satisfaction to all concerned.

The construction and successful operation of this refuse disposal station for a period of twenty-six months has furnished information on many points of waste disposal work which heretofore were in doubt.

It has established the fact that the refuse of any large city when separately collected can be utilized by marketing a large proportion and consuming the worthless parts, under the most exacting conditions, without nuisance or annoyance to the neighborhood, and that steam power can be maintained to an amount many times greater than that required to operate the station.

The quality and value of refuse is directly proportioned to the care exercised in separation, the faithfulness of the men doing the work of collection and the protection given by the passage and enforcement of regulations governing the service.

The operation of this station relieves the city of Boston from the complaints of nuisance from floating refuse; saves a considerable sum in transporting this for ten or twelve miles, and gives far more capacity for ashes in loading the scows.

The Boston Refuse Disposal Station is an object lesson in the disposal of refuse that would repay investigation by the authorities of any city where this municipal waste gives trouble in disposal, and is produced in sufficient quantities to pay the expenses of separate collection and utilization.

METHODS OF SEWAGE DISPOSAL.

For more than two years the State of Connecticut has had a sewerage commission at work. In an endeavor to solve the problem of sewage disposal, much valuable information about modern methods now in use has been secured, and appears in the second annual report of the commission. The personnel of the commission is of a high order, when measured by ability, Prof. Edward H. Jenkins, of New Haven, being chairman, and City Engineer R. A. Cairns, of Waterbury, as secretary. Three of the members spent a portion of last year making investigations abroad, much to the advantage of the work. A summary of the report, giving the valuable results of the studies of the commission, follows:

The chemical precipitation of domestic sewage, first and most extensively practiced in England, has proved to be very unsatisfactory. It is very expensive and at best can only prepare the sewage for purification, a work cheaply and effectively done by the septic tank. A single possible use for it is this: Where many large adjacent manufacturing establishments contribute chemicals and very refractory waste matters which are injurious to the bacterial life of the filters, it may prove to be economical to separate them in a special sewer and make them innocuous by chemical precipitation. Probably the sludge thus made would carry less water and be more dense than that from the treatment of house sewage, and its disposal for these reasons would be less burdensome.

The cleansing of sewage by bacterial action is the only method which seems, at present, to give promise of widely successful applica-

tion. To the study and practical operation of this method the work of all sanitary engineers is at present directed. No other known method actually destroys the putrescible matter in sewage, making the effluent clear, not poisonous to fish and incapable of putrefaction. No other known method can, therefore, perfectly satisfy reasonable requirements in those cases where the effluent must be discharged into streams or shallow harbors.

Largely by the experiments and advice of the Massachusetts State Board of Health, the capacity, durability and efficiency of sand filters for the bacterial treatment of sewage beds has been determined. With a sufficient and not exceedingly large area, crude sewage can be handled on them, yielding very clear and clean effluents. There is no clogging of the filters, and while their efficiency is very considerably reduced in severe winters—owing partly to the lessened activity of the bacteria in them, and partly to the impossibility of cleaning the surface of the beds—they are operated successfully the year through in Massachusetts and in Connecticut.

Sand filters themselves efficiently screen the sewage. The sludge, consisting of paper with solid animal and vegetable refuse of all sorts, does not work down into the sand, but stays on or close to the surface, and if not removed simply retards the work by checking the flow of sewage into the sand. When the filter rests, this sludge dries to a thin crust, easily removed by raking, and is composted or directly plowed in, making a fairly good fertilizer.

The sand filter has its limitations. In the first place, for cleansing the sewage of very large cities, the filter area must necessarily be very large and relatively much more expensive because of the high cost of land near large centers. Secondly, only very open, coarse sand can be profitably used for filters, and such sand is often not to be found where it is needed for the purpose. This last condition prevails almost everywhere in England, and has made necessary the very expensive and elaborate experiments with so-called bacterial beds.

Bacterial beds are artificially made, being filled with some kind of broken material very much coarser than sand. Burnt clay, furnace clinker, coal, even crushed granite and refuse metal scrap have been used. The depth of the filters is usually from 3½ to 6 feet, though in some cases it has been as great at 13 feet.

The method of operating these filters is quite different from that used for sand filters. The latter are flushed with sewage which is allowed to sink through the sand, the sewage rests for a day or more, the beds are raked, and then flushed again. The former are filled slowly up to the surface of the filtering material with sewage, which is allowed to stand for two or three hours and is then slowly run off. After a rest of only a few hours, the operation is repeated, two, three or four times in twenty-four hours. The effluent from the first or roughing filter is usually passed to a second, filled with finer material, and in a few cases to a third, but the third contact is exceptional.

This system at its best will unquestionably handle six or eight times as much sewage as an equal area of sand filters. The effluent is not nearly as pure, but pure enough to meet the present requirements of sanitary authorities. The climate of England in winter, which is much milder than our own, does not appear to very seriously affect the working of these beds if the sewage is applied as described. An automatic sprinkling device for continuously applying the sewage to the surface is reported to have disabled the bed in freezing weather and would certainly do so in Connecticut winters.

The bacterial bed, like the sand filter, also has its limitations, which are now fully recognized by all English authorities. The material of these beds is so coarse that sludge is not held on the surface but readily passes up or down, depending on the manner of filling, into the body of the filters. A considerable part of it is liquefied and destroyed there, the bacterial filter thus operating like a septic tank, but a part is very resistant and fills up the interstices more or less. This filling, with careless or unskillful management, is very rapid; with skillful management, it is slow. The commission believes, however, that the experience even with screened and settled sewage has not yet proved that this filling can be wholly prevented, and that it rather indicates that with all possible care sewage will so seriously impair the filters in no very long time as to make renewal necessary, unless practically all the sludge is removed from it by some preliminary treatment. This operation of renewal, at least under Connecticut conditions, would be very expensive.

This brings up again the problem of the removal and disposal of sludge, the suspended matter in sewage. No mechanical arrangement of gratings or sieves has yet been devised which can do the work required. Once remove the sludge and the problem seems to be solved. If the sewage is free from it, there is no reason to doubt that the bacterial filters can handle seven or eight times as much sludge-free sewage as an equal area of sand filters can handle of crude sewage, and will maintain their efficiency indefinitely.

The most efficient means of removing this sludge has proved in England to be the septic tank. It has long been in successful operation at Exeter; at Sutton it has insinuated itself into use with a system originally devised to remove the sludge by a roughing filter; at Manchester it has been finally adopted as part of the disposal system of a great manufacturing city, by a commission of undoubted ability, which made a thorough test of it. It may be that the septic tank, in some places, and with some kinds of sewage, will prove unnecessary, and that the whole work can be done on bacterial filters.

The work of a septic tank has been accomplished in a long trunk sewer, and, as English experience also has shown, too long continued septic action is decidedly objectionable, probably because it generates products which are inimical to the bacterial life of the filters.

Any careful observation of a number of sewage-disposal works emphasizes the fact that while the broad principles involved are the same everywhere, no two problems are precisely alike, and each particular case has to be studied by itself and the system modified to meet local conditions and the special character of the sewage to be treated. It has still to be determined whether the septic tank and bacterial filters can be used in the Connecticut climate in their present shape, or whether they can be so modified as to be successfully operated here during the summer and winter. The work of sewage disposal in England under the special conditions imposed by the demands of sanitary authorities, the general character of the soil and the geographical situation, is still in the experimental stage. No large manufacturing centers have disposal works which have been in perfectly successful operation for a considerable number of years. The septic tank is no longer an experiment. The bacterial filters operating on sewage quite free from sludge are, the commission believes, certainly successful, and will continue so indefinitely without renewal. At any rate, the work now being done at Manchester will, if managed with the same skill as the preliminary experiments, finally settle these two points.

The cleansing of the sewage of large manufacturing cities is often made specially difficult because of the discharge into sewers of manufacturing waste water either containing in solution various chemicals which greatly interfere with bacterial filters or carrying in suspension material which clogs these filters. Examples of such matters are pickling acid, soap, paper-mill waste, bleach and gas liquors. These have at present to be accepted in the sewers and cared for by the city. In many cases, however, such waste should be, in part, at least, kept out of the sewers and out of the waterways by private manufacturers, without loss and even with a profit to themselves. The following interesting examples are described by Dr. H. W. Wilson:

"The county of the West Riding of Yorkshire (which includes the cities of Leeds, Sheffield and Bradford, and the boroughs of Halifax and Huddersfield), has a population of 2,444,391, engaged chiefly in the manufacture of textile goods, leather, iron and steel, and in coal mining. In this county there are more than 2,000 factories discharging trade refuse into the sewers or streams. Those manufacturers in the iron trade who used to discharge waste pickle, made from sulphuric acid, have found in several cases that it is easy to obtain from this pickle by crystallization the copperas it contains, and to use over again the acid mother liquor, and in this way to cease discharging the waste pickle into the stream, and at the same time to affect an economy by its treatment. The manager of the Hallanshire Paper Mills, near Sheffield, has assured the board's inspector that he is able to rinse the fiber, etc., caught in the settling ponds he has provided for the treatment of his trade waste, and that by so doing he has far more than recouped himself for the cost of the works. The manager of the Calder Grove Paper Works, near Wakefield, also states that all the sludge deposited from the waste water in the set-

tling tanks he has provided can be made up into paper. In both of these cases the sludge is used also with other materials for the manufacture of the coarser kinds of paper. In the case of bleach works it has been found that the measures adopted by the manufacturers have resulted in a saving. The occupier of the Woodside Bleach Works, Rawdon, has saved $30 a month by rinsing the bleach liquor which formerly he discharged into the stream. At several soap works the manufacturers have erected plants for the recovery of the glycerine from the lyes and have thus stopped the former pollution of the stream and at the same time made a profit."

The recommendations which the Connecticut Sewerage Commission makes to the Governor are as follows:

"*First.*—The disposal of sewage without nuisance is a duty which each community owes to the public. It is a problem to be settled by each community for itself, with such State supervision and control as is necessary in the public interest.

"*Second.*—No city, borough or town which has not now a sewerage system should be allowed hereafter to build one which will discharge sewage or polluted water into any stream, whether such stream at the time is used by others for sewage disposal or not; nor should private corporations of individuals be allowed to discharge house sewage or excreta into any streams or rivers.

"*Third.*—To insure sewerage construction and methods of sewage disposal which will be permanently satisfactory, the General Assembly should not grant to any corporation, not now operating a municipal sewerage system, authority to issue bonds for building, or to condemn land for building, or to build any sewers or system of sewers, until an accurate topographical survey of the region to be sewered has been made, and, together with plans for effective sewage purification before discharging the effluent into any stream, has been submitted to and approved by some competent State authority.

"*Fourth.*—Provision should also be made by which cities and boroughs now having sewage disposal works, or which may hereafter build them, may be compelled by the State to so manage them that the sewage shall at all times be effectively purified, so as not to create a nuisance by its discharge into rivers."

The report contains a valuable history to date of the sewage disposal difficulties of New Britain and Waterbury, and an illustrated description of the sewage disposal works in Great Britain which were visited last summer. The illustrations included a number of views of the special aerating filters built at Accrington, which has the most concentrated sewage in England.

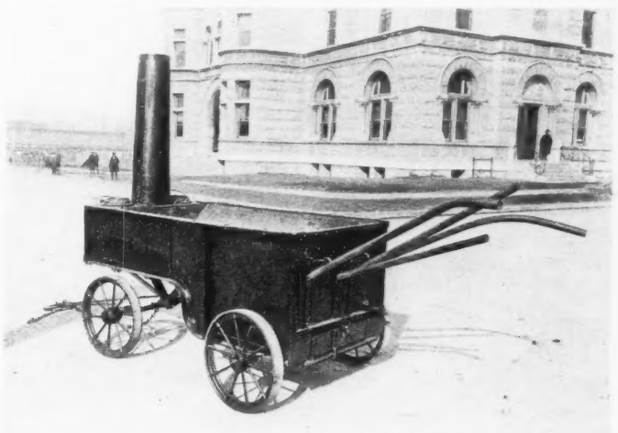
A copy of the full report can be had on request, it is likely, of the secretary, City Engineer Cairns, Waterbury, Conn.

HOW TO REPAIR ASPHALT PAVEMENTS.

BY ROBERT HOOKE, CHATTANOOGA, TENN.

THE asphalt heater and fire-wagon shown in the accompanying cut was designed last summer especially to meet a want experienced in the city of Chattanooga. This city had about 25 miles of asphalt pavements, which had been down from nine to twelve years. These pavements were all laid by the Warren-Scharf Asphalt Paving Company, and up to March of last year none of them had been resurfaced, but during that and the following month the Barber Asphalt Paving Company resurfaced two whole blocks, and one side of another block, on Market street, the principal business street of the city. On all of the old pavements but one, the maintenance guarantees had expired, and repairs had become frequently necessary. The Warren-Scharf Paving Company had in Chattanooga a stationary plant, erected in 1888, when the first Market street pavement was laid, but Chattanooga was so far from the principal base of operations of this company that frequent visits of the repair forces was, of course, not to be expected. Means of our own for the prompt repair of breaks in the asphalt pavements resulting from openings made by plumbers, gas, water and railroad companies, as well as those resulting from ordinary wear and deterioration, became not only very desirable, but absolutely necessary, if we were to preserve the continuity of the asphalt surfaces. With the view of experimenting in the work of making its own repairs, this city purchased last year a number of tons of pavement mixture from the Barber Asphalt Paving Company, and as no portable heater for reheating this paving material could be found in the market, one was especially designed for the purpose by the writer, and was built at one of the local boiler manufactories.

In this heater or asphalt repair plant is combined a fire-



ASPHALT HEATER AND FIRE WAGON—PART OF ASPHALT REPAIR PLANT—CHATTANOOGA.

wagon for heating the iron tampers and smoothers, a pan in which to reheat the pavement mixture, and kettles for containing asphaltic cement for use in painting the joints. This portable asphalt repair plant may be drawn by three men on moderate grades, but when more than a single batch of material is to be used, it is attached to the rear of a wagon and thus taken to the street, where the work is to be done, the wagon being also used to transport paving material and fuel for the heater.

This portable asphalt plant was first put into use the latter part of November, 1900, and it has been used on all asphalt repairs made since that date, which, to March 1st of the current year, aggregate 492 square yards. Of this repair work 71 square yards were made with new pavement mixture, and the remainder, or 421 square yards, was made with old material. The repairs were made on eight different streets, and the work covered between 300 and 400 separate holes or breaks in the pavements from those of a single square foot up to 50 square yards of surface. All of the repairs that were made with new pavement mixture have been quite satisfactory, but those made with old mixture have not been uniformly so, as recent inspection has revealed in the case of some of the latter a pitted surface, different from the indented surface presented by new pavements in summer time, in that the pits seemed to have resulted from the loss of material rather than from mere indentations, such as are made by the caulks on the shoes of horses and so frequently

observed on new asphalt pavements in warm weather. The cause of these pits is due to fragments of burned material occurring in the surface of the layer, and this burned material, soon pulverizing, is washed out by the rain, leaving the holes or pits referred to. The holes are of variable size, depending on the extent of the burned pavement mixture, which usually consisted of fragments of the mixture that were allowed to adhere to the bottom of the pan, while being heated, until burned, and were afterwards removed from the pan with the rest of the mixture. These defects are confined almost entirely to the work that was done soon after this repair work was inaugurated, and before the men engaged in it had acquired the requisite knowledge and skill in the manipulation of the pavement mixture while it was being reheated. In the last repair work done in which old material was used, no such defects have been observed, although sufficient time has elapsed since the work was done for them to have developed, had the conditions favorable to their development been present. This burning may be prevented by taking care in turning the mixture, after the water has all been vaporized, to have the point of the shovel follow closely the sides and bottom of the pan so that there shall be no layer left in contact therewith long enough to suffer burning.

The process followed in the reheating of the pavement mixture, whether of old or new material, is to first break the material into fragments not greater than four to six inches in width and length, but the smaller the fragments the quicker the material is reheated, and then, after pouring water into the reheating pan until it is three or four inches in depth over the bottom thereof, to fill the pan with the material to be reheated. A cover is placed over the pan to partially confine the steam and to hasten the heating of the material that is above the water line. After the material begins to soften, the cover is removed and two men, provided with shovels, begin to chop and subdivide with these tools the top fragments of the paving material, and then, turning the material so as to bring to the top the larger fragments from beneath, the operation of chopping with the point of the shovel is continued. This is done to expedite the softening of the material. The entire mass is turned until the water has all boiled away and the material thoroughly melted throughout. If old material is being used, about one-half gallon of residuum oil is now added to the batch of material, which is again turned until the oil is well distributed through the mixture, which is then ready to be applied to the street. It is intended, in future repair work, to add to the old material, when reheated, a certain quantity of asphaltic cement instead of residuum oil alone.

In repairing new asphalt pavements, or those that are comparatively new, new pavement mixture should be used, but in the case of old pavements there is no good reason why the repairs should not be made with old material, if the latter can be treated in such manner as to give to the repair work made with it a duration of life that shall not fall short of that of the remainder of the original pavement. The repairs made with old material will cost about 60 cents per square yard, while if new material be used the cost per square yard would be about three times as great, so that even if a portion of the repairs made with old material had to be renewed before the end of the repair period, the difference in cost would still be in favor of the old material. The city of Chattanooga has some half dozen asphalt streets which have now been in use so long that the expectation of life in the case of these pavements may not be more than from three to six years, that is, by the end of these periods the area of the annual repairs required will be such a large fraction of the total area of the pavements that further repairs will cease to be economical, and a general renewal of the asphalt surface will be called for. Many other cities, probably the majority of those having asphalt pavements, have pavements of similar age and condition to those in Chattanooga, and which may be repaired with old material in the same manner as the repairs are made in this city, at a great saving. A supply of old material may not always be at hand, in which case new pavement mixture would have to be used, but the excavations that are made from time to time in the streets, necessitating the removal of portions of the asphalt surface and the general resurfacing of the old asphalt streets, will yield a large quantity of old material, which may be used to advantage as far as it goes.

This portable asphalt heater is operated by three men, and when more than a single batch of material is to be used, a wagon and team is employed to take the tools and materials to the street, the combined fire-wagon and asphalt heater being attached to the rear of the wagon. If repairs are to be made which involve only about three square yards of asphalt surface, the wagon and team are not used and the plant is taken to the street by the three men themselves. In this latter case the pan will be filled with the paving material, sufficient water poured in, the fire started, the kettles filled with asphaltic cement and the men then proceed with the fire-wagon and mixture heater to the street where the repairs are to be made, introducing into the fire-box on their arrival at the street, or at such time as may be necessary, a smoother and tamper, or two of each if required, so that they may be heated and made ready for use. No roller is used in making these repairs, only the tamping and smoothing irons. The capacity of the smaller size plant is from 15 to 18 square yards per day, or from five to six batches of material. For the larger plant it is designed to make here, the day's work will be from 25 to 30 square yards. The cost of operating the plant for a whole day has been about as follows:

Labor 3 men, at $1.10 each	$3.30
Wagon and team	2.50
Fuel, 1-5 cord wood	.60
Residium oil and cement	1.00
Total	$7.40

This makes the cost of the repair work when old material is used about 50 cents or less per square yard. With the larger size plant of five square yards to the batch, the cost will be less than 40 cents per square yard. The cost of the work when new pavement mixture is used is somewhat less, as it is more quickly prepared for use. The total cost of the repairs made with new pavement mixture has been, so far, about $1.40 per square yard, or $1.00 for the mixture, and $0.40 for the work of putting it down. The price heretofore paid to the asphalt companies for repair work was $1.80 per square yard. The 492 square yards of repairs made since last November would at this price have cost the city $885.60. The actual cost of the work to the city was

$401.25. This amount includes $55.95 paid the Barber Asphalt Paving Company for new pavement mixture, the cost of recovering old material from the dump where it had been partially covered with other waste materials, and the cost of a foreman for a considerable portion of the time the repair work was in progress. No foreman is now employed on the asphalt repair work, as it has been found that as much work per day, and as good work, can be done without one. The three laborers assigned to this work are given employment on the general street repair force when not engaged on asphalt repairs, so that they are always available for the latter work when wanted. The total of $401.25 includes not only the items mentioned, but all expenses incident to the asphalt repair work except the cost of the plant itself.

The inauguration by municipalities having asphalt pavements of the method adopted in Chattanooga for making light repairs of these pavements, will not take from the asphalt paving companies any work that has heretofore been profitable to them. The writer ventures the opinion that, even at the price of $1.80 per square yard, the Warren-Scharf Asphalt Paving Company never made any money on the asphalt repair work done in Chattanooga, and it is probable that the same thing may be said of the paving companies making light asphalt repairs in other cities.

This plant is not designed for resurfacing an entire block, or any considerable portion of one, at a time, but merely for making those ordinary repairs of the asphalt surface which, if not promptly attended to, are a source of such great annoyance to those using the streets and especially to the city authorities who are charged with the responsibility for their repair and maintenance. That the city authorities may, with their home labor, be able to promptly repair a break in asphalt pavement on its first appearance will serve to further popularize these pavements, and to remove an objection to them that has heretofore been offered by many, to the effect that only the skilled employees of the paving companies can make these repairs and that these skilled employees are not always at hand.

The success and usefulness, in Chattanooga, of the portable asphalt plant, or, as it is called in the application for letters patent, the combined fire-wagon and asphaltic mixture heater, have led to arrangements being made to manufacture it in this city.

PICTURESQUE SURPRISES.

For natural and picturesque scenery the Lackawanna Railroad is the peer of any of the great trunk lines of this or any other country, and the traveler over its superb system between New York and Buffalo, is treated to a glorious panorama which he will remember with pleasure.

Leaving Buffalo on a day train, the traveler, seated in one of the luxurious coaches of the Lackawanna, views pictures of meadow and hill, valley and mountain, plains dotted with pretty little villages, with now and then a more pretentious city, sweeping rivers and brooks swiftly running through rich meadow land, on which are threaded, like pearls on a queen's necklace, glistening lakes and ponds. On every side the journey of 400 miles between the great cities of New York and Buffalo is replete with picturesque surprises, and nowhere i nthe United States can its equal be found.

The employees are courteous and attentive, and ever on the alert to add to the enjoyment of this trip.

If you are contemplating a visit to New York or Buffalo, you will not regret having taken the Lackawanna.—*The Workman.*

PORTLAND CEMENT SIDEWALKS.

BY FRED J. WARREN, BOSTON.*

FRED J. WARREN, Boston.

Portland cement sidewalks are generally laid under the names kiolithic, granolithic, artificial stone, monolithic, etc. All of these are arbitrary names used to describe the particular class of work done by the owner of the trade-mark, and the life of the work under any of the names depends entirely upon the skill and care used in the selection of the materials and the construction of the walk. The work is generally laid in three courses; viz.:

First—A foundation intended to permit the thorough drainings under the slab of concrete, and at the same time be elastic enough to take up the swelling action of the frost in itself and in the ground underneath, without injury to the concrete above it.

Second—A base course, intended to supplement the top course, and give the walk the rigidity and strength necessary to withstand the bending or breaking action due to sudden jar, settling of foundation, action of frost, etc.

Third—A wearing surface, primarily intended to take the wear and tear of traffic.

The construction of the top, or wearing course, is of the utmost importance, for upon its life depends the life of the walk. This wearing surface should be as dense as possible, that is, it should have as few interstices as possible between the grains of stone or sand forming the aggregate, and between the grains of cement or fine particles of the aggregate, as by this means the water is excluded to the greatest extent, and the freezing action of the absorbed water is reduced to a minimum. The proportions of cement, sand and small crushed stone to attain their end can only be determined for each special case. By selecting the aggregate to be used, cement can be added until the mixture shaken down will attain its greatest density, and after that point is reached, a further addition of cement makes the mixture lighter, possessing a greater proporton of voids, and thus making the mixture more porous and less durable. Any great excess in the amount of cement necessary to produce the result mentioned above, also has a detrimental effect on the surface of the walk, in that, instead of presenting the

* The construction of asphalt pavements, bituminous concrete and cement sidewalks has been developed into a known science, so that there need be no more uncertainty about results. This end has been achieved very largely through the persistent investigation, study and experiment of Mr. Fred J. Warren, of Boston, who has been engaged in the practical and scientific phases of the work since 1883. He has accomplished, in a comparatively short period of time, what might have taken others a lifetime. His work has been easier, perhaps, because he is one of the family of Warrens who were among the first importers and refiners of asphalt in the United States, and the first engaged in the use of coal tar in this country. City engineers and all others interested in the construction of bituminous pavements or cement sidewalks will be pleased to learn that the accompanying article, by Mr. Warren, is but the first of a series which will appear from time to time in the MUNICIPAL JOURNAL AND ENGINEER, upon various phases of the subject, in which he will, for the first time, give the public the benefit of his valuable experience.—[EDITOR OF M. J. & E.

surface to the wear of traffic, it is borne by the cement itself. On account of the glassy nature of the cement when set, the surplus will make a highly polished surface, which is uncomfortable to walk upon, and will be avoided to a large extent if the idea in mind is to make a wearing surface of sand and small stones, firmly bound together with Portland cement.

A sidewalk proportioned properly with reference to the voids of its constituents will attain greater ultimate strength than one where cement is much in excess, due to the expanding action of the grain of the cement in setting, which has a tendency to crowd the particles of cement adjoining it, and hence, while the mixture is hard and flinty, the internal stress of the particles is such as to neutralize the strength gained by age in the setting of the cement. This may readily be seen in cement briquettes made for testing purposes. The briquettes made of neat cement increase in strength for three to six months, and then fail to gain any appreciable strength, and often decrease after that period, while those made with a proper mixture of sand increase steadily for five or six years, or longer.

This detrimental effect of the expansion of the cement is not confined to its effect on the surface, as the expansion longitudinally is often so great that it will cause the blocks to flake at the joints, due to the great pressure caused by expansion, and often pushing the curbstone out at the street corners, sometimes to the extent of five or six inches.

The proportions of the materials used in the base should be determined according to the usage to which the walk is put. Ordinarily the amount of cement advisable is less than that which is necessary to give the greatest density, as a certain depth is necessary to give the blocks enough weight to make them rigid, and only enough cement is necessary to give those blocks the strength requisite to withstand the usages to which the walk is put. If a surplus of cement is used above the amount necessary to fill the voids in the base course, the concrete is more subject to contraction and expansion as affected by cold and heat. That is to say, that if a slight amount of voids is allowed to exist in the base course the expansion and contraction which must necessarily take place both by changes in atmospheric temperature and by chemical action will be taken care of without a fracture in the concrete slab.

The function of the foundation is, as stated before, to afford proper drainage and to minimize the upheaving action of the frost. Hence it will be seen that when the walk runs from building to curb, the water has practically no opportunity to get under the walk, and the drainage space may be reduced to three or four inches, while in cases where a grass plot exists on one or both sides, the foundation should be deeper. Experience has proved that it is not necessary in any case to put the foundation below the frost level, and the depth of the foundation in extreme cases need not be more than twelve inches, even in the most severe climates on the North American Continent. This foundation can be formed of any porous material, such as gravel, furnace cinders or coarse sand.

It should be borne in mind that the usual tests applied to determine the value of a cement, as recommended by the American Society of Civil Engineers, are not conclusive as to the efficiency of a cement for use in sidewalk work. The cements which often stand the best tests, according to standard methods, have been proven to be absolutely inferior under the conditions to which sidewalks are subjected. In laying sidewalks it is generally the case that the surface of the concrete is permitted to dry out within a few days from the time it is laid, and the ultimate strength of the concrete is largely the strength attained at the time the moisture has been permitted to entirely leave it; it therefore follows that it is absolutely essential to the best work that the cement used should develop great strength, with a minimum amount of water, when exposed to moisture during a short length of time. The fact that Portland cement sidewalks are permitted to dry out too quickly, is often the cause of inferior work where the cement has not been properly selected with a special view to this use. The three important things on which the life of a concrete depends are:

First—Selection of the cement.

Second—Selection of the mineral aggregate.

Third—Care and skill in mixing and laying.

These requirements can only be attained by long practical experience, supplemented by careful laboratory work. Practice and laboratory work will demonstrate that a specification fixing given quantities of cement and mineral matter to be used in the construction of concrete work will not develop the best results unless the specifications are drawn with a view to the use of the mineral matter which had hitherto been tested. In other words, the varying surface areas and sizes of grain of mineral matter, and the varying proportion of voids should be considered in determining the quantity of cement, sand or stone to be used.

HOW TO LAY TAR MACADAM.

WIDESPREAD attention has been attracted to the successful laying of tar macadam roads in the city of Hamilton, Ontario. Many officials from nearby cities in the United States have made pilgrimages to the Canadian city to inspect the work and learn "the how of it" with varying success. City engineers and other officials will be interested in the following description of the work in Hamilton, by City Engineer Wingate, under whose supervision the tar macadam was laid. He writes:

"Last year our city constructed about 70,000 square yards of tar-macadam roadway, costing $75,000, including curbing, which is half of the $150,000 fund that was voted on and appropriated for this purpose, leaving $75,000 more to be expended in similar work this year. Tar-macadam was constructed by corporation labor and none by contract, and cost in the neighborhood of 95 cents per square yard, based on labor at 18 cents per hour and refined coal tar delivered found on board cars in Hamilton at $3.75 per barrel of 50 United States gallons. During the year 1899 there were about four miles of this class of pavement laid by corporation labor, and costing not quite 80 cents per square yard, but this was based on labor at 15 cents per hour and coal tar at $2.60 per barrel. The stone used is of a hard bastard limestone quarried within the city limits and with an average haul of one and one-half miles, costs about $1.15 per cubic yard for the hand broken stone and 95 cents for the machine broken or crushed stone delivered upon the site.

"The advantages claimed for this pavement are that it is free from dust, easily swept compared with plain macadam, and owing to the

tar mixture, causing a complete adhesion to the stone making it impervious to water and thereby holding the pavement in a permanent position as originally laid, and no moving or rolling of stone as often experienced in a plain macadam roadway. I might mention also that there is no wear to the top dressing, as it is calculated that the latter will soon either peel off after evaporation sets in, or crumble away, leaving the large stones as a wearing surface. The dressing is merely intended to be evenly spread over the tar macadam and well rolled in with a heavy steam roller, and as before stated, making the surface compact and close and impervious to water. With reference to the durability or lasting qualities of this class of pavement, I do not feel that I am yet in a position to say definitely, owing to the short time it has been laid, but I have every reason to believe that the same will prove durable, fairly clean and free from dust, easily swept, and will require to be repaired only every third year on the principal streets where the traffic is heaviest, and on residential streets, where the traffic is light, every fourth or possibly fifth year, by spreading a new coating 2 inches thick of tarred stone with dressing on the full width of roadway, and at a cost not to exceed 25 cents per square yard. This, you will observe, divided by three years, would be 8 1-3 cents per square yard annually for the principal traveled streets, and for the residential streets from 5 to 6¼ cents per square yard. In this connection, it might be of some use to quote you a letter that I addressed to one of our Canadian cities in reply to four questions asked by them as follows:

"'1st. We have practically adopted tar-macadam roadways and spent in 1900 something like $75,000 in that class of work, and will continue to lay that class of pavement this year to the extent of $75,000 more, a by-law having been passed for $150,000 to cover these two years.

"'2d. We are well satisfied with it and feel quite sure that we have discovered the proper pavement, when you come to consider the low first cost, and its wearing qualities being equal to a higher priced pavement.

"'3d. I can recommend it for the principal streets of your city, especially for ——— and ——— streets, and further that it will prove suitable for a pavement along the railway track.

"'4th. As to the system of drainage, we depend altogether on the gulley drains at the side to carry off the water, the surface of tar-macadam, being impervious, prevents any water getting through the pavement to the foundation.'

"The first tar macadam laid by the city of Hamilton was laid in the year 1880, a little over twenty years ago, on Mulberry street, one block of about 400 feet, by the Hamilton Gas Light people, and although this pavement is not in a first-class condition to-day, an expenditure of 25 cents per square yard would make it nearly equal to a new roadway. There has been little or no expense on this pavement during all that time. The second tar-macadam was laid in 1891, on West avenue, of about three blocks, or 1,200 feet, 22 feet in width between curbs, one of our principal residential streets, but the traffic was fairly light until the year 1896, when a large building, the Collegiate Institute, was constructed, necessitating the carrying of much heavy material over this street, and it was surprising the way the tar-macadam stood the wear, the repairs of which have been only nominal, being a few holes that were patched up new, making a pavement as good as formerly. These two latter pavements were laid in a most primitive way, and not to be compared to the manner in which we are doing the work now under the revised specifications; but notwithstanding the inferior work at the time, it is proving to be an economical roadway and has been the cause of our taking up the question of better pavement and the adoption of tar-macadam. A third pavement with a somewhat better specification of tar-macadam roadway was also laid in the year 1893 by the Hamilton Gas Light people, with a ten year guarantee for maintenance of same, on King William and John streets, two principal streets near the heart of the city, over which much heavy traffic passes, for a total distance of four blocks, or say 1,600 feet, for the sum of $1.75 per square yard. This pavement had little or no repair until the year 1899, when an arrangement was made with the Gas Light people, and the city was directed to make the necessary repairs and charge to them, the same having been completed over half of the distance and costing 31 cents per square yard; which, distributed over six years, from 1893 to 1899, would be 3½ cents per year.

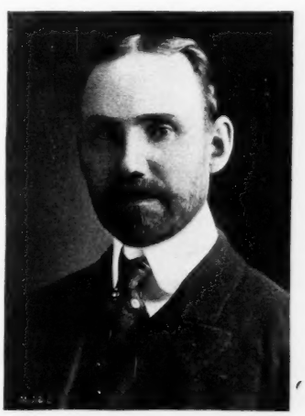
"In this connection it might be well for me to mention that many deputations from various cities throughout the United States have visited us during the past two years on inspection trips for the purpose of seeing for themselves this pavement as laid on our streets, and so far as I can ascertain they have all been favorably impressed, and I have heard from several, stating that they had concluded to adopt tar-macadam in their own cities.

"I am aware that tar-macadam is not a new thing, as it was used years ago in the Old Country with more or less success, but in the States it has generally proved a failure, particularly so in Washington, where it was tried and failed in the year 1871. Very recent cases have been tried in the State of New York after parties had visited us and tried to do as we had done, but I have learned that it was a partial failure, and upon request I sent a man from here to help them out of the difficulty the best he could, which he succeeded in doing.

"These failures are caused by not having the proper knowledge pertaining to the tar mixing, which is essentially a job that must be left to the discretion of the man in charge, as it is quite difficult to fix any hard and fast rule, as so much depends upon the quality of the tar, the temperature while heating, the dryness of the stone and the quantity of pitch. Then, too, it is absolutely necessary to have hard, porous rock which is found in the limestone. With the use of broken granite for a tar macadam roadway one would have very little success, owing to granite being so close grained that it will not absorb the tar, unless thoroughly dried and baked on hot plates, which makes it expensive."

FRANCHISE TAXATION IN SAN FRANCISCO.

BY WASHINGTON DODGE, ASSESSOR.



WASHINGTON DODGE,
Assessor, San Francisco, Cal.

THE constitution of California declares that "all property shall be taxed in proportion to its value," and further declares the word "property" to include "*franchises,*" and "all other matters and things real, personal or mixed, capable of private ownership." Our Supreme Court, ten years ago, declared that it knew of no more just or equitable way of arriving at the value of a franchise, than to deduct from the market value of the shares of stock of a corporation the value of its assessed property, the difference representing the value of the franchise. Following this decision, the court held that shares of stock in a California corporation which could not be assessed to the holder thereof, were all the property of the corporation, including its franchise fully taxed. (This for the reason given that it would be double taxation, which this same court has declared to be prohibited by the constitution.) Our Legislature then promptly passed a statute, forbidding the taxation of shares of stock in California corporations. It therefore, under our laws, is necessary to tax the franchise, or allow the intangible property of the corporation to escape all taxation.

Our constitution allows quasi-public corporations no deduction from their property on account of bonds issued, and

hence our courts have decided that the owners of such bonds cannot be taxed thereon.

The rule I adopted, therefore, for determining the value of a franchise of a quasi-public corporation was to add the market value of its securities (stocks and bonds), and to deduct from such sum the assessed value of its tangible property (real and personal). This gave the value of its property remaining untaxed, representing for purposes of taxation under our revenue laws the value of the franchise. Having determined its market value, its value for assessment was fixed at such a percentage of this sum, as governed the assessment of other property, which, in this State, is from 60 per cent. to 75 per cent. As a result of this procedure, the total assessment roll of the city and county of San Francisco has been increased in two years over 7 per cent., or about $25,000,000. This increase is due entirely to the increased franchise assessments of quasi-public corporations.

The consolidated street railroad, known as the Market Street System, had the assessed value of its franchise increased from $7,000,000 to over $17,000,000. The franchise of the Water Company has been increased from $4,000,000 to over $12,000,000. The balance of the increase is at the expense of the Telephone Company and various gas and electric and street railroad companies.

To the credit of these corporations let it be said that they have paid their taxes without litigation, thus adding over a quarter of a million annually to our revenue. Our corporations now contribute sufficient in taxes to pay for the lighting, sprinkling and sweeping of our city, and also to defray the entire expense of the maintenance of Golden Gate Park and all of our smaller parks.

An attempt, partially successful, has also been made to assess the franchises of our large industrial corporations. Most all of those so assessed were combinations of industrial corporations with very large capitalization, and were all paying regular and remunerative dividends on their stock. It is, in our State, peculiarly appropriate to levy an assessment on these franchises, as our revenue laws exempt the holders of their stock from paying any tax thereon, and there is no other legal way to tax the value to the corporation. Thus, taxpayers holding half a million dollars in stocks of California corporations have regularly claimed exemption from taxation of their wealth so represented, claiming that the various corporations paid taxes on all the values represented thereby. As a rule, the assessment of the tangible property of these corporations amounted only to from 5 per cent. to 20 per cent. of the amounts invested in their securities; the balance of all sums so invested escaping all taxation. As our constitution declares that franchises are property and shall be assessed, making no distinction between the franchises of a quasi-public corporation and an industrial corporation; and as the Supreme Court has exempted the stockholders in California corporations from assessment of their stock on the theory that if "all the property of the corporation, *including its franchise,* is fully assessed, to then assess the shares of stock would be double assessment," it clearly becomes the duty of the assessor to see that such franchises are adequately assessed. This had never been attempted in our State, but in last year's assessment in this city, many millions were added to the roll by the assessment of such franchises. This is the same principle that Gov. Odell's measure taxing corporations, recognizes. An assessment if the franchise to the corporation, as the trustee of the stockholders, falls equally on each stockholder, and is practically made in lieu of an assessment of his stock. No stockholder can escape, and, therefore, this method is preferable in its results to a tax levied directly against the holders of the stock; some of whom are honest enough to pay, but most of whom evade the payment thereof. By this system of taxation, the owners of corporate securities are made to contribute their just share in taxes. Professor F. W. Tausig, in the *Political Science Quarterly* of March, 1890, advocates the justice and necessity of such taxation, in order to compel holders of industrial securities to cease this evasion of their taxes, and further to thereby interpose some barrier to the growth of enormous industrial corporations or trusts. The United States Supreme Court has confirmed the right of a State to assess the intangible property of a corportion by taking as a basis for the valuation thereof the market value of its securities; namely, its stocks and bonds. The court declares in plain terms what the property of a corporation is worth for purposes of income or for investment, as shown by the market valuations of its securities, that it is worth for purposes of taxation. (166 U. S., p. 217.)

The value of these franchises was fixed on the basis of the market value of their stock, which is usually an accurate measure of their dividend earning capacity. Due allowance was made for what might be claimed to be a speculative or fictitious valuation or for the hazardous nature of a business.

A number of corporations so assessed paid the tax on their franchise; a large number have refused to pay and have carried the matter into the courts for a judicial interpretation of the law and a definition of the assessor's power. We are hopeful, however, of having our action sustained.

The law of California declares that the franchise of a corporation is assessable where it has its principal place of business, as declared in its articles of incorporation. Those corporations having their corporate home in San Francisco fall within the jurisdiction of its assessor. There is no provision in our revenue laws for the taxation of such property by the State. There is on foot a movement to amend our revenue laws so as to make a uniform assessment of corporate property and overcome some of the objections to the present plan of assessment, which arise through defective legislation, as it is realized that our revenue laws present many imperfections.

NEW JERSEY'S GOOD ROADS.

BY WILLIAM L. DICKINSON, SPRINGFIELD, MASS.

IT is generally admitted by those well informed on the progress of the "good road" movement in this country, that New Jersey takes the lead over any State in the Union for the best, most economically constructed and maintained system of roadways built under State aid.

The original New Jersey State aid law was enacted and approved March, 1891. The law has been amended by several supplementary acts, but the main features remain the same.

New Jersey has the honor of being the first State to aid

A NEW JERSEY ROAD BEFORE IMPROVEMENT.

in the construction of public roads by appropriations of money from the State treasury.

The law makers of other States have examined the New Jersey State aid law and its workings, with the result that several States have adopted the principle of the law, modifying it to meet their own conditions.

The building of continuous stretches has been found to be the most economical. The longest continuous line built in 1900 was 23.26 miles, and the largest mileage built in any one section was 34.34 miles.

Another fact that should not be lost sight of is that the State has lent its aid without incurring a debt for coming generations to pay.

Hon. Henry I. Budd, commissioner of public roads, has had a large and varied experience in the construction and maintenance of roads and deserves great credit for his careful, economical and patient work. One finds, by mingling with the people, that they have profited by his experience and his advice for first-class construction, a proper system of maintenance, and a continuous system of roads has been quite generally accepted.

Up to January 1, 1900, the State assisted in the building of 440 miles of roads, at a cost of about $2,200,000, or about $5,000 per mile. Of this amount the State paid $716,000, the counties and individuals paying the remainder. The cost for 1900 will show a slight increase on account of the advance in price of crushed stone resulting from the combination of the different firms dealing in this material. Also, the railroads charging more for transportation.

The cost of some of the roads ten feet wide and eight inches deep of crushed stone has been from $3,000 to $3,500 per mile. The width of the roads varies from ten feet to thirty feet.

There is a large mileage of macadam roads, fourteen feet wide and six inches deep, where the total cost was $4,000 per mile. In some sections a thin macadam road, four inches deep and ten feet wide, has been built, costing from $1,500 to $2,000 per mile.

In many sections of the State there is an absence of suitable stone for macadamizing, and the crushed stone has to be carried by rail a long distance. Oftentimes the stone costs $1.50 per ton delivered on the railroad, and it costs twenty-five to fifty cents per ton to deliver this on the works. This brings the cost of the roads up very materially, especially where a deep cut is made to reduce the grades and under drains used to secure proper drainage.

The cost of some of the earlier roads was $9,000 per mile, but by careful management this has been gradually reduced, while the wearing quality is equally as great.

Up to the present time the State has assisted in the building of about 600 miles, and the counties have built 600 miles, making a total of about 1,200 miles. The counties are obliged to maintain all of these roads, the State only assisting in the original construction.

The road laws of New Jersey provide for a supervisor in each county, who shall be constantly watching for and correcting all tendencies toward distintegration. They also allow any private citizen to mandamus the county officials when they fail to keep up a proper system of maintenance. All the machinery is provided to keep those roads models of excellence.

The following method used in the construction of some of their Telford roads gives good results:

When the excavation and embankment has been brought to a proper depth below the intended surface of the roadway, and the cross-section thereof, conforming in every respect to the cross-section of the road when finished, the same is then rolled with a ten-ton steam roller until approved by the supervisor. If any depressions form under such rolling, owing to improper material or vegetable matter, this is removed and good earth substituted, and the rolling continued until thoroughly solid and brought to the proper grade. After the course of stone of average depth of eight inches is set by hand as a close, firm pavement, the stones are placed on their broadest edge, lengthwise across the road, and so as to break joints as much as possible. The breadth of the upper edge should not exceed four inches. The interstices are then filled with stone chips, firmly wedged by hand with hammer and the projecting points broken off. No stone should be used of a greater length than ten inches, or width of four inches, except each alternate stone on the outer edge, which is double the length of the others, and well tied in the bed of the road; all stones with a flat, smooth surface are broken.

A NEW JERSEY ROAD AFTER IMPROVEMENT.

The whole surface of this pavement is then subjected to a thorough settling or ramming with heavy sledge hammers and thoroughly rolled with a five or seven-ton roller. No stone larger than one and one-half inch is left on top of this Telford surface.

On this Telford surface a binder is spread in a uniform layer and the rolling continued until the stones cease to sink or creep in front of the roller. Water is applied in advance of the roller, but not in excess. The quantity and quality of this binder is subject to the approval of the inspector.

On top of this binder is placed a second course, which consists of one and one-half inch stone. This course is spread in a uniform layer of sufficient thickness to make the crushed stone at least three inches in depth when completed. Over this is placed a coat of three-quarter inch stone and screenings, and rolled until thoroughly settled into place to the satisfaction of the supervisor.

After the two courses are properly rolled, another coat of three-quarter-inch stone and screenings is spread of sufficient thickness to make a smooth and uniform surface to the road, then again rolled until the road becomes thoroughly consolidated, hard, and smooth, so that a small stone placed on the surface will be broken before being driven into the bed.

The rolling is done with a ten-ton steam roller. Water is applied in such quantities and in such a manner as to completely fill all the voids between the broken stone, with the binding material saturated so as to secure a perfect bond. In the rolling the roller should start from the side lines of the stone bed and work toward the centre.

A large mileage of roads are built entirely of crushed stone eight inches deep, in two layers. The foundation is prepared as above described for a Telford road. On this foundation is placed the first course of stone, consisting of two or two and a half inch stone, which is deposited in a uniform layer to a depth of four inches, and well rolled. On this course of stone a quantity of stone screenings are spread, uniformly and thoroughly rolled with a ten-ton steam roller until brought to a solid bearing.

The second course of stone consists of one and one-half inch stone, spread in uniform layer and well rolled. A quantity of screenings are then spread in a uniform layer and the rolling continued until the stone ceases to sink or creep ahead of the roller. Water is applied in advance of the roller, but not in excess.

After the two courses are rolled to the satisfaction of the inspecor, a coat of three-quarter-inch stone and screenings is spread of sufficient thickness to make a smooth and uniform surface to the road, then again thoroughly rolled until the road becomes perfectly consolidated. Water is applied during the rolling in such quantities and in a manner to completely fill all the voids between the broken stone with the binding material saturated so as to secure a good and perfect bond.

Sand is sometimes used with the screenings as a binder, also clay loam, but it is doubtful if it is advisable to use clay in any form in a road bed. It is true that in dry weather it makes a road fine and smooth, but during the fall and spring it is a factor in throwing the stone out of position by the action of the frost.

UNDER DRAINING WORK ON OLD YORK ROAD, NEW JERSEY.

In those sections where there are stone walls along the sides of the road, or stones lying about the adjoining fields, a boulder Telford foundation is laid. On this foundation a layer of one and one-half inch crushed stone is placed and binding material used, consisting of sandy loam, three-quarter-inch stone and screenings, all thoroughly rolled and brought to a proper finish.

In some sections of the State four-inch macadam roads are built. Wherever the right conditions exist, and the roads properly constructed on a very carefully prepared foundation, good results have been obtained.

Throughout the State both horse and steam rollers are used, but better results are obtained from the use of ten-ton steam rollers. A horse roller can be used to advantage where the foundation is of a loose or sandy nature.

Good judgment has been shown in many instances where a road has been built with ten feet of macadam in the centre, and gravel or good-road material on each side. The sides of the road are quite generally used by the traveling public in dry weather, and the macadam in wet weather.

All of the State roads are built under the contract system, the lowest responsible bidder receiving the contract. Proposals are received under the specifications for the road complete.

By the exact system of measurements in constant use by the State supervisor in charge of new construction, the contractor is obliged to furnish crushed stone to the required depth according to specifications.

The cost of these roads has not been a burden. The benefits derived are found in the greatly increased valuation of property, a large increase in population of a desirable class, and in all lines of trade. The farmers find a great advantage in the easier passage of their products to market and a great saving in the wear and tear of their horses and vehicles. Over a continuous good road heavy loads are hauled with a less number of horses than were formerly required for a small load on a poor road.

NEW LIBRARY AT NEWARK.

NEWARK, N. J., opened its new Free Public Library on March 14, with appropriate ceremonies. The reading public of that city may now be served with the greatest facility,

FRANK P. HILL, A. M.,
Librarian Newark Library.

the books cared for and indexed after the most approved methods, and the city beautified by the architectural excellence of the structure as well.

A special library commission was created some months ago, of which Librarian Hill was an active member. The commission, after viewing many of the best examples of library building, at length submitted their views to the architects. Plans were drawn and accepted, and the supervision of construction was placed in the hands of Thos. E. Clarke, who gave careful attention to all details.

The site for the building cost about $100,000. The original appropriation for building was $250,000, but this amount was subsequently increased by $50,000 to provide for the lighting equipment.

The building is of Indiana limestone, and the architectural design is that of the Italian renaissance.

The structure is four stories in height, and built in three sections, namely, the main building and two semi-detached portions, one of which contains the stack room, and the other for the accommodation of the heating, lighting and power plant.

Entrance to the building is through a double vestibule. Once inside a very noticeable feature is the architectural beauty of the central court, which occupies the center of the building, and rises through three stories. The connecting corridors form, therefore, the balconies surrounding this court.

On the street floor are the newspaper room, noticeable for its size, with the usual conveniences. On this floor, also, is the children's room. The idea here embodied is not altogether new, but it is well worked out in this instance. It is well calculated to be of interest to the little folks. Further back on this floor, the arrangement being duplicated on both sides of the building, are the lavatories and coat rooms for the attendants, and also the bicycle rooms, with racks to accommodate about twenty-five wheels.

The second floor accommodates the general delivery room, the card index room, the public offices of the librarian, a check room, and the general reading room. A salient feature of the delivery and stock room is the abundance of light. The books are all made readily accessible to the public, yet all is brought well under the administrative control of the attendants. The general reading room is noticeable because of its spacious dimensions. It may well be termed a hall. Its decorative features are in the best of taste and lend a fitting air to the whole.

The apartments on the third and fourth floors are designed to meet more special needs than the rooms previously mentioned, unless we may except the research rooms, which are well calculated to facilitate special investigations. The other rooms on the third floor are the sumptuous trustees' room, impressive because of its luxuriance; the official cataloge room, another for the attendants, and the librarian's private offices. The fourth floor is given up to the art gallery, museum and lecture room, which will seat between three and four hundred persons.

The library has a well-equipped bindery, which is in active operation. Elevators and devices for transferring books from one portion of the building to another are noticeable features.

Deserving of special mention is the stack building, which is six stories high. As near as may be, it is calculated to be dust proof. The windows cannot be opened, thus necessitating galleries around the outside of the building, whereby to make possible the cleaning of the windows on the outside. As the stories are very low, three galleries suffice to reach the six stories. Another anti-dust device, if it may be so termed, are the air exhaust flues at the corners of the stock rooms. Powerful air draughts passing down these flues seize the dust and carry it away. When a volume is dusted it is done near one of these flues, and consequently the dust is drawn down and not permitted to settle again upon the books. Communication between the stack building and the working rooms is readily had by well-devised appliances. Everywhere noticeable is the fact of completeness and adaptability.

FREE PUBLIC LIBRARY, NEWARK, N. J.

Superintendent of Lamps and Lighting Robert J. McCuen, of Baltimore, is one of those city officials who believe in a degree of ornamentation being secured with even useful and necessary public utilities. Mount Royal avenue, which is a very wide street and a popular driveway and thoroughfare leading to Druid Hill Park, with the converging streets, is to be made attractive by a harmonious and ornamental arrangement of street lamps. Now the avenue is lighted by electricity, but Superintendent McCuen intends to change this to gas, as he can secure a better and more effective display with lamp posts. The design for the street lamps has not yet been decided upon, but there is $10,000 appropriated for the carrying out of the plan. Besides this, Superintendent McCuen means to improve the appearance of the public buildings, which occupy three blocks, one next to the other. Electric light poles of an ornamental design will be installed, and the City Hall, Post Office and Court House will be accordingly beautified. The unsightly arc light poles and unused gas lamp posts are to be removed and the gas lamps will be permanently discarded.

MUNICIPAL JOURNAL AND ENGINEER

PUBLISHED MONTHLY AT 253 BROADWAY, NEW YORK CITY.

C. M. PALMER, PROPRIETOR.

WILLIAM S. CRANDALL, Editor.

CONSULTING EDITORS.

EMIL KUICHLING, C. E., ... Consulting Engineer, 209 Clinton Ave. N., Rochester, N. Y.
WM. C. WOODWARD, M.D., LL. M., ... Health Officer, Washington, D. C.
CHARLES E. PHELPS, JR., ... Electrical Engineer, Baltimore, Md.
ALEXANDER POTTER, ... Consulting Sanitary Engineer, New York City.
WILLIAM R. HILL, ... Engineer Aqueduct Commission, New York City.
E. H. CHAMONT, B. S., PH. D., . . . Sanitary Chemist and Bacteriology, Cornell University, Ithaca, N. Y.
DAVID HUNTER, JR., ... Superintendent Public Lighting, Allegheny, Pa.
BENJAMIN MURPHY, ... Chief of Police, Jersey City, N. J.

JOHN B. BENNETT, Business Manager.

Advertising Department: E. J. HERMANS. E. T. WHITE.
Circulation Department: J. T. EMERY. W. I. RELF.

TERMS OF SUBSCRIPTION. (In advance.)

United States and Canada . . . . . $3.00 per year.
Foreign Countries . . . . . 4.00 "
Single Copies, each 25

Entered at the New York Post Office as second class matter.

NEW YORK, APRIL, 1901.

EDITORIAL COMMENT

The work of the reformers in New York moves rather slowly, but it promises greater results later.

The local millionaire will have to "step lively" and build that library or Andrew Carnegie will get there before him.

The New York police is doing some good work in these days on the East Side, and many of the police justices are warmly seconding its efforts.

The Municipal League of Scranton, Pa., in its crusade against civic misrule, is achieving results which should make it the envy of organizations in other cities. New York's reformers might, perhaps, learn a thing or two from their Scranton brethren.

Governor Odell has made for himself many friends by his refusal to yield to Senator Platt's importunities for the introduction and passage of the Constabulary Bill. It was a purely partisan measure, wholly antagonistic to home rule and calculated to do no end of harm.

Our friends in the fire departments throughout the country will find much to interest them in this number. Supplement No. 2, showing Chief Croker in his office, is presented to the Chiefs with our compliments. This photograph was taken especially for the MUNICIPAL JOURNAL AND ENGINEER.

The western civic politician heralds from the house top what the eastern man whispers in the cellar; one seeks publicity, while the other courts secrecy. An Oakland (Cal.) paper contains the terms of an agreement made by a successful candidate over his own signature, on which he bartered away the offices of his appointment. Of the two evils, the bolder is the less menacing to good government.

The water works superintendents and others who are interested in perfecting local water departments will find that Supplement No. 1 contains valuable statistics from fifty-one cities of 50,000 population or over. At the expense of much time and labor it was compiled by Superintendent Waters, of Grand Rapids, Mich., through whose courtesy we are permitted to give it to our readers. It contains, among other things, a convincing argument in favor of the use of meters.

The city of St. Paul has just made the discovery that much cheaper street paving can be secured by competition. Formerly the specifications for asphalt pavements called for a certain brand of asphalt controlled by a single company, thus practically prohibiting competition. City Engineer Claussen believed that the city would materially profit by real competition, and, therefore, so revised the specifications as to permit of it. Result: a saving of thousands of dollars for the taxpayers. Other city engineers please follow suit!

A barber in the western part of this State has been sued for damages by a customer, who claims that he was infected with "barber's itch" in his shop, and that, as a result, he has been put to considerable expense in getting rid of the disease, besides being badly disfigured by resulting scars. There should be a law enacted which would provide for the enforcement of certain sanitary regulations to prevent like occurrences. There has been such a law in operation in Michigan, Missouri and several other States for a number of years with most satisfactory results. If the city health officers would push the matter, a similar law might be passed in this and other States.

The Capital City, like many other cities in America, has a multiplicity of lamp, electric light, fire and police alarm and postal boxes on the street corners. How to get rid of them has been a problem, the solution of which has puzzled the municipal authorities for a long time. Washington thinks it has found an answer to this important question in the article on "Municipal Street Signs" which appeared in the March issue of the JOURNAL. In the near future, following the suggestion in the above-mentioned article, a useful and ornamental pole will replace the ugly substitutes which have long been eyesores to the city. This affords a good argument why every city official should subscribe for the MUNICIPAL JOURNAL AND ENGINEER.

There is a great deal of crimination and recrimination on the part of the friends and opponents of municipal ownership. Exaggerated statements on either side do more harm than good to the side using them. The sentiment in favor of the ownership or control of such public utilities as water, gas, electric lighting and street cars, is making substantial headway. One potent cause of its growth has been the persistent and rabid opposition of the large corporations. The latter begin to realize their mistake, and are less frequently seen at State and national municipal conventions endeavoring to counteract the influence generated by these conventions in favor of civic ownership. In fact, several prominent pro-corporation people have declined invitations to take a place on the program.

MUNICIPAL HOUSING.

THE effort now being made by certain reform organizations to press a bill at Albany for a model municipal tenement building, constructed and managed by the city, seems to be a great mistake. It is not likely that under existing political conditions it would come any nearer to being a model than the better class of philanthropic enterprises along the same lines, such as the City and Suburban Homes Company, which shows the possibility of sanitary tenements at a four or five per cent. profit. In fact, there is great danger that the business would be so mismanaged as to be a set-back to municipal management of monopolies. The latter is infinitely better suited for

public administration because conducted under the public eye, where abuses would be brought to light, and because the business being a monopoly, the comparison is not between the enterprise characteristic of competitive business and public management, but between the latter and corporate management of an industry not regulated by competition, and necessarily accompanied by most corrupt relations with city governments.

There is no monopoly in house building, and I doubt if many cases can be found of the desirability of cities entering upon competitive business. The only monopoly in the tenement house question is in the land, and that can be reached better by a gradual increase of tax on land and a gradual diminution of taxes on improvements, coupled with sufficient manhood and grit on the part of the American people to lead them to improve and enforce sanitary laws and regulations.

The only reason the English people have attempted municipal construction and operation of tenements is that they have a still worse system of taxation of land than have we, and there is a great repugnance over there to enacting proper laws for the public weal at the expense of the individual Englishman's so-called property rights. This I found on personal study of the subject in various portions of England last summer, and I write it in full sympathy with the tendency to increase municipal activities in many directions.

EDWARD W. BEMIS.

A CRUSADE FOR GOOD ROADS.

THE "Good Roads Train," of which considerable has been said in the newspapers, will start upon its itinerary about the middle of June. The Hon. H. S. Earle, chairman of Michigan's State Senate committee on good roads, and also president of the League of American Wheelmen, is behind the scheme. In asking for the co-operation of the MUNICIPAL JOURANL AND ENGINEER, Senator Earle writes:

"I expect to start from Chicago about the middle of June, and will make a belt line from coast to coast, but I cannot tell which direction the train will take until all applications are in. Then I will date my entire tour and give out the information of where, when and what.

"I shall be accompanied by the Hon. Martin Dodge, Director of Public Road Inquiries, of Washington, D. C., together with a corps of experts from the department.

"At first it was planned to cover only four or five central western States, but the demand for the "Good Roads Train" has assumed such proportions that the plan has been enlarged to include portions of the entire country."

Any of our readers who wish to know more about the proposed movements of the "Good Roads Train," or to get in touch with Senator Earle, can do so by addressing "Good Roads Department," MUNICIPAL JOURNAL AND ENGINEER.

This movement should receive the hearty support not only of the railroads, but also of all road improvement organizations and citizens in general.

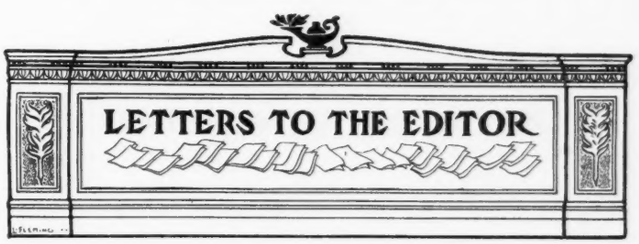
THE GREEDY PRIVATE CORPORATION.

THERE are some unwise, not to say greedy, corporations serving various municipalities. They do more harm to their side and excite more enmity to their cause than all the anti-corporation forces put together. New York City has several of these unwise corporations.

A recent report of Commissioners of Accounts John C. Hertle and Edward Owen to Mayor Van Wyck on the subject of car license fees and taxes on gross receipts due from street railroad companies in this city shows that the arrears for ten years to October 1, 1900, of the companies operating in Manhattan, and for two years past of those in Brooklyn, amounted to $224,291.98. The report quotes from a previous report made in January, 1899, in which it was shown that there was due to the city from street railroads in Manhattan, $875,460.30 for paving between the tracks. This work should have been performed by the railway companies, but it was done by the city at the expense of the taxpayers and charged to the accounts of the railroad companies. These two amounts make a total of $1,099,752.28.

There is no corporation so powerful which can afford to thus disregard its rightful obligations, whether they be to an individual or to a city. That the just dues of the city have been demanded and that the proper officials have performed their duty is evidenced by this report, hence it has not been connived at by the civic authorities. The taxpayers are too engrossed with their personal affairs to take notice of so small (!) a matter, at least at present. But, sooner or later, the demand of the civic authorities for the payment of the debt will be backed up by an aroused public opinion, and the obligation will have to be discharged, with the inevitable result of arousing greater antagonism against a corporation which could be guilty of such unbusinesslike methods.

Another case in point is that in Rochester, N. Y., where the street railway company contested a similar claim, but with the consequent result in favor of the city. Moreover, the sentiment favoring either the ownership or control of the street railway system in Rochester has been greatly strengthened, and the company is a double loser. Such, also, is sure to be the result in the case of the New York roads.



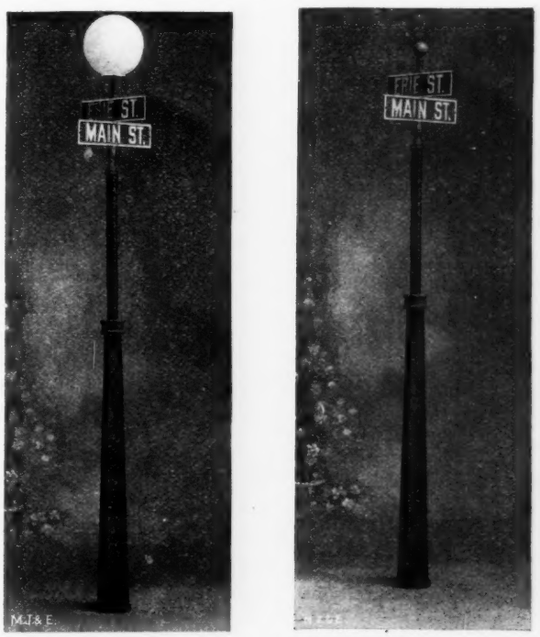
MORE STREET SIGN DESIGNS.

796 Eleventh avenue, New York, March 25, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

My attention was attracted to the article on "Municipal Street Signs" which appeared in your March issue, and, in response to your request for other designs, I take pleasure in submitting my own.

The accompanying illustrations will show that these street signs or markers meet all requirements for a modern city.



STREET SIGN DESIGNS.

This sign has several unique features in its construction, and presents a fine appearance. It is durable in every detail and manufactured of the best material. It is legible and can be read from all directions, and requires no cleaning. It is adapted to use either with or without the lamp attachment. It can be attached to lamp posts now in use, or may be placed on posts of special design, as seen in

accompanying illustrations. The posts are light, strong and durable, being made of cast and wrought iron. F. K. PLUMBLY.

A CORRECTION.

ROCHESTER, N. Y., March 15, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

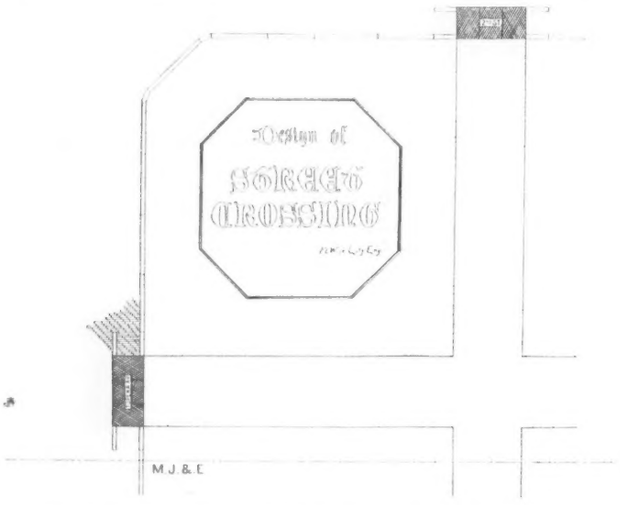
I would call your attention to errors concerning the cost per capita and tax on $1,000 in the city of Fall River, Mass. Figures in the third column for this city should be $.024, and in the fourth should be $.034. Please accept my thanks for laying this table before your readers. M. O. STONE, *Secretary.*

STREET SIGNS USED IN TOPEKA.

TOPEKA, Kan., March 13, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

I enclose blue prints showing crossing plates and street signs such as are used in this city. Signs placed as shown can be seen by everyone. There are eight signs at each intersection, but neither unsightly



STREET SIGNS PLACED ON IRON PLATE AT STREET CROSSINGS—TOPEKA, KAN.

posts nor anything to be tacked on the side of buildings or attached to fences. Since their adoption, these signs and crossing plates have become very popular, and now the citizens would allow us to use no other signs here, provided we were so disposed.

P. L. WISE, *City Engineer.*

CIVIC PROBITY COMMENDED.

———, Wis., March 19, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

I was much interested in the editorial commendation in the March issue of the methods of transacting the business of Cambridge, Mass., and I shall be greatly surprised if you have any large number of replies naming cities having equally good records. I do not wish to express by this my unbelief in the average integrity of city officials, for I believe they measure up to any other class of men—ministers not excepted—who are placed in similar positions and surrounded by like conditions. If there be a large amount of corruption in municipal affairs there is a good reason for it, for there can be no effect without a cause. I look upon this corruption, where it exists, as the result of a cause, and I name that cause as partisan politics and the non-payment of a salary, particularly to the municipal legislators.

Long observation of many cities leads me to suggest the following remedy: Abolish partisan politics, establish civil service rules, pay every man employed in the city government a salary commensurate with his service, publish a résumé of each department's work once a week, or month, in the daily or weekly press; expect and demand fidelity. C. M. L.

TWO LETTERS FROM PRESIDENT JOHNSON.

GOTENBURG, Sweden, Feb. 23, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

I am now possessed of sufficient facts so that I can give your readers sufficient information about the celebrated "Gotenburg System" of handling the liquor traffic. On October 1, 1865, the system was inaugurated by the city, but owing to contracts and concessions then in existence, it was not until 1875 that it secured full control of the traffic.

The corporation is capitalised for $56,000, on which it receives 6 per cent. interest, or profit, annually; all other profit is turned over to the city and various public institutions. From 1875 to and including 1898, it has turned into the various funds entitled to the same, the sum of $4,558,060.80, the highest sum any one year amounting to $259,005.12.

All liquors are inspected, and must bear a certain standard of purity.

When the corporation came into complete control, it found one saloon where strong drink could be obtained for each 8,569 persons; in 1889, there was one for each 17,481 persons. In 1868 there was one public house for every 2,293 persons; in 1899, one to every 8,158 of population.

The corporation makes its own regulations as to the sale of liquors. The hours for selling for public houses and saloons are from 8 A. M. to 7 P. M. The difference between a public house and a saloon is that in the former they must sell hot and cold eatables at all hours. The persons authorized to sell liquors receive no profit on the sales; they are paid a certain sum for their services and for help, which sum is deducted at certain times by the corporation. The corporation furnishes rooms and fixtures where liquor is sold, and the persons having the sale are prohibited from selling to those under eighteen years of age, or to anyone who shows any signs of being under the influence of liquor, nor are they permitted to sell only a certain number of drinks (not enough to affect them in any one place) at the same time, or in quick succession.

If the figures can be relied upon, there can be no question but that this system has decreased drunkenness, as may be seen by the following:

In 1870 the average consumption per head of population was 11.6 litres, while in 1893 it had been reduced to 4.66 litres—a litre is a trifle more than one-fourth of our gallon.

The object of the corporation is set forth in the articles of incorporation, as follows:

To prevent the sale of intoxicants on credit.

To provide well lighted and ventilated rooms.

To provide cooked food at moderate charges.

To lower the percentage of alcohol.

To limit the quantity of spirits procurable by any one person at any one time.

To raise the age limit of young persons to whom liquors may be supplied.

To shorten the hours when spirits are sold.

To supply good and cheap food for the working classes.

The system has been extended to nearly every city in Sweden, as well as in Norway, with somewhat varying conditions. That it is a fixture here no one can doubt. I have before me the endorsement of it from the Governors of eighteen Provinces in Sweden.

J. A. JOHNSON.

———

BRUSSELS, BELGIUM, March 12, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

From the standpoint of municipal ownership of public service industries, Amsterdam, Holland, is the ideal city, in so far as I have been enabled to examine into municipal conditions in European cities. It not only owns and operates its water works, gas and electric lighting plants, but also owns and operates an extensive telephone system. In addition to these, on January 1, it took possession of the street car system, since which the City Council has appropriated $2,400,000 to change from horse to electric power, which includes a provision for an adequate power plant.

This acquisition on the part of Amsterdam of the natural monopolies has not been a spasmodic affair by any means; it has taken one

thing at a time, testing it until it proved thoroughly satisfactory before the next step was taken. Mr. Robinson, the British Consul, who was the managing director of the water works when in private hands, asserts that not only is the service better, but the rates are much lower under municipal ownership.

Gutenberg, Sweden, is next to Amsterdam as a municipal ownership city. It has just bought out the street railway corporation, and will also change from horse to electric power as soon as possible. Aside from telephones, it owns and operates—or will soon—all that Amsterdam does. In addition to this it derives all real profits from the sale of liquors, which I have described in a former letter to the MUNICIPAL JOURNAL AND ENGINEER.

I have investigated the question of municipal taxation and believe that I am now in a position to give your readers a little more information on that most interesting question. Consul George W. Roosevelt, a cousin of Vice-President Roosevelt, located here, is my authority.

In addition to assessing all real and personal property, as in the United States, they levy what they call "Extraordinary Taxes." For example, the tenant is taxed for living in a rented house! In addition to the regular taxes paid by the owner, each door and window in the house is taxed. There is a tax levied on water, in addition to the regular price paid for water rent, as is also gas and electricity. Every animal and vehicle is taxed in addition to the regular tax and all kinds of business are taxed. All servants are taxed; men servants paying 20 francs per year, and maid servants half that amount. There is also an inheritance tax and when you die your heirs must pay a tax to get you out of the way.

In the purchase of real estate you pay 10 per cent., in addition to the purchase price, to the government. Besides all this, in France and Germany, there is an income tax to pay; in Belgium it has been abolished.

Consul Roosevelt assured me that the same system prevailed in France, Holland and Germany. I thought, when I was in Sweden, Norway and Denmark, that taxes were high; but they don't begin to measure up to those found in the countries named.

J. A. JOHNSON.

ESTIMATED COST OF LIGHTING PLANT.

————, Mass., March 11, 1901.

Editor MUNICIPAL JOURNAL AND ENGINEER:

What would probably be the cost per light, to a private corporation, to furnish, say 200 arc lights of 1,200 candle power, to run all night and every night, or 4,000 hours, when coal costs $4 per ton delivered?

If we could know the cost to the corporation we could then ascertain whether the company was demanding more than a fair income on the money invested. EDWARD S. WILKINSON, *Mayor.*

In answering a question of the above character it must always be borne in mind by the reader that conditions might exist which would materially increase, or possibly decrease, the figures submitted. Under conditions stated above, a conservative estimate, as given by Mr. Hunter, of Allegheny, Pa., our consulting editor, would be as follows:

Cost of plant at $250 per lamp	$50,000.00
Depreciation charges, per lamp	$12.50
General supplies, water, insurance and repairs	11.00
Coal, at 4 per ton	20.00
Labor, including office	18.00
Total cost, per lamp	$61.50

The cost of coal is based upon a consumption of seven pounds per kilowatt hour. This estimate covers the cost of an open arc system; if the plant in question is operating enclosed arcs, the total cost would be $55.50, or a reduction of $6 per lamp. In preparing the estimate it is assumed that the area involved does not exceed two square miles.—[EDITOR M. J. & E.

Governor Odell has signed the Ramapo Repeal Bill. This act closes an incident which redounds to the credit of Governor Odell, former Governor Roosevelt, Comptroller Coler, the Merchants' Association, and others who had a hand in the fight.

PERSONALITIES

—W. H. Davey, Democrat, has been elected Mayor of Butte, Montana.

—M. L. Milligan, Republican, has been elected Mayor of Springfield, Ohio.

—Hiram G. Hotchkiss, Democrat, has just been elected Mayor of Lyons, N. Y.

—John B. Boehne, Democrat, is reported as elected Mayor of Evansville, Ind.

—Mayor Homer S. Cummings, Democrat, has been re-elected in Stamford, Conn.

—Mr. George E. Goodman, of Nappa, Cal., gives to his home town a $20,000 library.

—Mayor George W. Furbush, of Lewiston, Me., was re-elected at the recent election.

—Mayor W. C. Oille, of North Tonawanda, N. Y., is just beginning his second term.

—Mayor Phelan, of San Francisco, is strongly at variance with all the newspapers of his city.

—Mayor Samuel M. Jones has been re-elected for the third time the Mayor of Toledo, Ohio.

—Mayor Arthur Chapin, of Bangor, Me., recently polled 1,253 votes out of a possible 1,257.

—H. C. Frick, of Pittsburg, Pa., has donated $5,000 to the Mercy Hospital for a children's ward.

—Mrs. Antoinette A. Hawley, of Denver, Col., is the nominee for Mayor on a ticket composed entirely of women.

—Mayor F. E. Boothby's inauguration at the City Hall, Portland, Me., appears to have been quite a spectacular affair.

—Joseph McCall, treasurer of Lyons, N. Y., has the distinction of being the choice of both Democrats and Republicans.

—Mayor Colfax, of South Bend, Ind., seems to have given general satisfaction in his appointments under the new charter.

—The friends of William Hamilton, of Bayonne, N. J., claim him to be the champion long term City Clerk of the world.

—Mayor Davis, of Pullman, Wash., figures prominently in the agitation to prohibit boys from playing marbles "for keeps."

—Lawson B. Bidwell has been elected president of the Boston Society of Civil Engineers, and S. E. Tinkham, secretary.

—Mayor Samuel D. Leavitt, of Eastport, Me., died March 9 in Boston, while on his way home from the inaugural ceremonies at Washington.

—Mayor Landall Titcomb came near being the unanimous choice at Augusta, Me. His only competitor was "Mr. Scattering," who received seven votes.

—John N. Hinkle has been elected Mayor of Columbus, Ohio, on a platform favoring municipal ownership of all public utilities and a three-cent street car fare.

—The Hon. Tom L. Johnson has been elected Mayor of Cleveland, Ohio, on a radical platform, in which, among other things, he promises three-cent fares on the street railways.

—The late Senator C. L. Magee made provision before his death whereby Pittsburg is to benefit in the erection of a hospital, which is to be a memorial to the donor's mother.

—Hon. James A. Johnson, Mayor of Fargo, N. D., and president of the League of American Municipalities, landed in Portland, Me., on April 1, on his return from a three months' absence abroad.

PROGRESS OF THE L. A. M.

SECRETARY MACVICAR, of the League of American Municipalities, Des Moines, Ia., reports that the affairs of the league are in a prosperous condition. Since the Charleston convention, last December, the following additions to the membership have been made: Georgetown, S. C., Columbia, S. C., Morristown, N. J., Anderson, S. C., Fort Worth, Tex., Joliet, Ill., New Britain, Conn., Lincoln, and Omaha, Neb.

The proceedings of the Fifth Annual Convention of the league will soon be ready for delivery, and can be obtained from the secretary at Des Moines.

City officials throughout the country will be pleased to learn that the secretary has arranged with Director-General Buchanan, of the Buffalo Pan-American Exposition, to have the 26th of August observed as "Municipal Day," which will follow the adjournment of the sixth annual convention at Jamestown, N. Y. The Pan-American authorities will arrange a programme which will be of attraction to everybody who may be interested in municipal affairs. Secretary MacVicar assures us that among other prominent speakers will be included Vice-President Roosevelt, Ex-Governor Pingree, of Michigan; Hon. Thomas L. Johnson, of Cleveland, O., and Mayors James Phelan, of San Francisco; Samuel M. Jones, of Toledo, and Carter H. Harrison, of Chicago.

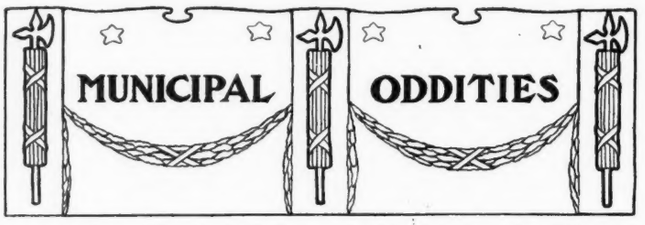
NATIONAL CONFERENCE ON TAXATION.

FOR some years the dissatisfaction with our methods of taxation, both State and local, has been growing apace. We have been so long accustomed to a system which was suited to the early conditions of our American life that we are only slowly awakening to its shortcomings in the light of modern business activity. Industry has overstepped the boundaries of any one State, and commercial interests are no longer confined to merely local limits. Corporate activity has largely changed the character of personal property and individual investments.

The problem of just taxation is no longer a local problem. It cannot be solved without considering the mutual relations of contiguous States and localities. An unequal tax on the farmer in one State may make it difficult for him to sell his products in the world markets. An unjust tax upon the manufacturer or business man may drive him out of business; an unfair tax on the corporation may cause it to move to another State. Action by any one commonwealth evidently reacts upon its neighbor.

As the time has come for those dissatisfied with the spasmodic and make-shift efforts at reform in some States to consider the problems involved from the higher standpoints of principle and of mutual co-operation, the National Civic Federation has called a conference at Buffalo, N. Y., May 23 and 24, and to this conference will be invited the friends of tax reform from the various States in the hope that it may formulate some ideas which will tend towards more uniformity and interstate comity.

From time immemorial Lowestoft, England, has rung the curfew at 8 o'clock at night, and turned off the street gas lamps at midnight. The latter fact has become so well known among thieves that it has facilitated burglaries; but thieving is likely to discontinue, as electric lights are promised for every night and all night. Electric tram cars are also promised.



—The city of Vineland, N. J., boasts of having the only millionaire mayor in the world who is working for one dollar a month!

—John B. Fogg, of Monmouth, Me., in length of service, is ahead of any city official in the country, having served as moderator (mayor) of his village for over forty years.

—It is currently reported that numerous city officials of Boston are suffering from what has been officially and medically diagnosed as "Taedium, Unum Sonum Habens et Nulla Varietate Delectans Vitæ." It is supposed to come of too many beans.

—The city of South Norwalk, Conn., keeps a part of its records in a chimney. This unique "safe" is found at the municipal electric lighting plant. The space usually utilized as a soot pit in the base of the 500-foot brick smoke stack has been utilized for keeping the records and books of the plant.

—The Rev. W. H. Wyman, who was recently appointed chief of police of Abington, Mass., by the selectmen of that village, has opened fire on the illegal transportation of liquor into a no-license town. Several people have been arrested and fined for such work, and hundreds of gallons of liquor seized.

—A gaunt she wolf was shot by a policeman in Franklin Park, Boston, recently. The animal was one of a pair of gray cubs that escaped one night about two years ago from a schooner lying at one of the wharves. The other one was shot about a year ago in the same park. Stories like this will have a tendency to confirm the belief in foreign countries that Boston and New York are not far from the "howling wilderness."

—The town of Fenton, about fifteen miles from St. Louis, enjoys the distinction of being the only incorporated town in the United States that is not governed by some kind of town officers. It was incorporated half a century ago. It was then supposed that Fenton would be one of the large towns surrounding St. Louis, but it failed to grow; the people became disappointed and did not think it worth the trouble to elect officers. Fenton is now chiefly known as a place where the bicycle riders go on Sunday, and where they regularly get their "chicken" dinner.

—Electricity was used as a weapon in a street railway war recently in Edgewater, N. J. A railroad company had laid a track illegally, so the civic authorities claimed, and a force of men was sent by the authorities to tear up the rails. A lineman employed by the railroad company threw a coil of wire across the overhead trolley wire and connected the ends with the rails in dispute. Four laborers who were sawing at the rails were hurled several feet by the electric current, and the attacking party was forced to retreat. But only for a short time, as the lineman was soon arrested and the city forces were victorious.

—Mayor Hatch, of Camden, N. J., it is reported, has awarded the contract for the summer supply of shirt waists for the policemen of that city. Nearly a hundred policemen were measured the other day. The material is to be madras and of a color described as French blue. The shoulders are to be raglan cut, the sleeves flowing to the elbow, a bit closer from the elbow to the wrist, and fastened at the wrists by elastic bands. The bosom is to be of pleated white linen. Down the front will be a row of six brass buttons and around the neck is to be a rolling collar. The star is to be placed on the left breast. The policemen are delighted with the garments.

—A skunk held possession of a busy portion of Trenton, N. J., for more than half an hour the other evening. Fire Commissioner Diehl stood on the street corner about 10 o'clock, languidly twirling his mustache, when he saw something crawl out of a sewer inlet. He yelled "scat," at which the animal immediately made the air redolent. Diehl went to cover in a nearby doorway and startled a napping policeman. Windows in the neighborhood went up and as suddenly went down. Street cars were held up. Stones and clubs hurled at

the beast caused it promptly to furnish evidence that it was still ready for action. Somebody suggested that the chemical engine be called and this was done. Within a minute the machine came rumbling up. The skunk showed no perturbation until the chemicals struck it full in the face, then there was a spasmodic convulsion, a little cloud of spray and smoke, a few flying clods of earth, a muffled wail and all was over. Traffic began again.

—Speaking of the recent incendiary speech of Mayor Daly, of Limerick, in which he suggested the burning of London by Irishmen, *The Portland Oregonian* says: "The best proof that Ireland is a land of considerable political freedom is the fact that a man entertaining and avowing these sentiments could be elected to a dignified office, and feels perfectly safe to utter rebellious talk and avow treasonable intentions in language that would cause his arrest in any other country save Great Britain as a political incendiary and seditionist. The mayor of a leading city in the United States who went abroad and proclaimed himself a rebel in intent, who would be a rebel in fact at the first opportunity, would not find any political friends on his return, and would be treated with marked contempt and suspicion the rest of his days by men of all parties. But this portentous speech by this Irish Invincible in New York City will only contribute to the gayety of the intelligent population of the United Kingdom, who will laugh at it as the familiar voice of the old-time cheerful Irish idiot, full of sound and fury, signifying nothing. The English rulers of Ireland hold this type of Irish agitators neither in fear nor in respect."

—In the recent mayoralty campaign in Topeka, Kan., so it is reported, the rival candidates, Colonel Hughes and Colonel Warner, were both noted for their religious zeal and goodness, the friends of each claiming the superior virtue of their candidate. The supporters of Colonel Hughes put forth the statement that he had not once missed a weekly prayer meeting in the last eighteen years, and they concluded by asking: "Can Colonel Warner say as much?" "It is true," retorted Colonel Warner, "that during eighteen years I have been absent from prayer meeting twice, but what are the facts? I can prove that I had malaria, and could not leave my bed. Nothing but severe illness would have kept me from weekly prayer meeting, and Colonel Hughes knows it." This explanation evidently impressed the public, and the Warnerites followed it up by declaring that during the last eighteen years Colonel Warner had entertained preachers at his house thirty times, including the bishop on two occasions. In addition, he had entertained ninety-two delegates to Sunday school conventions, prohibition conventions and Bible study conventions, whereas Colonel Hughes has always been backward in doing his duty in this respect, saying that his house was too small, whereas it is generally known that his house is larger than that of Colonel Warner.

THIRTY MILLIONS FOR LIBRARIES.

THE gifts of Andrew Carnegie, for the past twenty years, to cities for the founding of public libraries have amounted to the enormous sum of more than $30,000,000. But even this vast sum does not include a few of his later benefactions. The list follows:

TOWN OR CITY.	AMOUNT.
Aberdeen, Scotland, library	$59,000
Alameda, Cal., library	10,000
Allegheny, Pa., Carnegie Institute	300,000
Allegheny, Pa., observatory	20,000
Allegheny, Pa., library	25,000
Ashtabula, Ohio, library	15,000
Atlanta, Ga., library	145,000
Ayr, Scotland, library	50,000
Bauff, Scotland, library	5,000
Beaver, Pa., library	50,000
Beaver Falls, Pa., library	50,000
Bellefonte, Pa., State College	100,000
Birmingham, England, university	250,000
Blairsville, Pa., library	15,000
Blue Rapids, Kan., library	500
Braddock, Pa., institute	300,000
Braddock, Pa., library	200,000
Bucyrus, Ohio, library	500
Canton, Ohio, library	50,000
Carnegie, Pa., library	210,000
Chattanooga, Tenn., library	50,000
Cheyenne, Wyo., library	50,000
Clarion, Pa., library	50,000
Cohoes, N. Y., library	25,000
Conneaut, Pa., library	15,000
Connellsville, Pa., library	50,000
Creich, Scotland, library	7,500
Dallas, Texas, library	51,000
Dennison, Texas, XXI. Club	17,000
Davenport, Iowa, library	75,000
Decatur, Ill., library	60,000
Duluth, Minn., library	50,000
Dumfries, Scotland, library	50,000
Dumferline, Scotland, technical school	190,000
Dumferline, Scotland, library	50,000
Duquesne, Pa., library	200,000
Duquesne, Pa., Carnegie Institute	300,000
East Liverpool, Ohio, library	50,000
Eastport, Me., library	600
Edinburgh, Scotland, library	250,000
Edinburgh, Scotland, technical school	50,000
Emporia, Kan., library	50,000
Fairfield, Iowa, library	40,000
Fayette, Iowa, upper university	225,000
Fort Worth, Texas, library	50,000
Galesburg, Ill., library	50,000
Gloversville, N. Y., library	25,000
Grangemouth, Scotland, library	5,500
Greenville, Ohio, library	15,000
Greenburg, Pa., library	60,000
Guthrie, Okla., library	25,000
Hazelwood, Pa., library	4,000
Hempstead, L. I., library	25,000
Hoboken, N. J., Stevens Institute	50,000
Homestead, Pa., library	200,000
Homestead, Pa., Carnegie Institute	300,000
Houston, Texas, library	50,000
Inverness, Scotland, library	8,500
Jedburgh, Scotland, library	10,000
Johnstown, Pa., library	360,000
Keighley, Scotland, library	50,000
Lewiston, Me., library	50,000
Lincoln, Ill., library	25,000
Lincoln, Neb., library	75,000
Louisville, Ky., Polytechnic Institute	125,000
Matanzas, Cuba, library	2,000
McKeesport, Pa., library	50,000
Montclair, N. J., library	30,000
Montgomery, Ala., library	50,000
Mount Vernon, library	35,000
Newcastle, Pa., library	40,000
Newport, Ky., library	20,000
New Rochelle, N. Y., library	25,000
New York City, Bellevue Medical College	76,000
New York City, Carnegie Laboratory	50,000
New York City, Caledonian Club	2,752
New York City, Cooper Union	300,000
New York City, Montefiore Home	1,000
New York City, Zoological Society	5,000
Norwalk, Conn., library	50,000
Oakland, Cal., library	175,000
Oakmount, Pa., library	25,000
Oil City, Pa., library	50,000
Oklahoma City, Okla., library	25,000
Ottawa, Ont., library	100,000
Pennsylvania State College, library	100,000
Perth Amboy, N. J., library	20,000
Peterhead, Scotland, library	5,000
Philadelphia, Pa., University of Pennsylvania	100,000
Pittsburg, Pa., Carnegie Institute	2,000,000
Pittsburg, Pa., Carnegie Institute	1,000,000
Pittsburg, Pa., observatory	20,000
Pittsburg, Pa., Carnegie Institute	1,750,000
Pittsburg, Pa., relief in 1893	300,000
Pittsburg, Pa., Carnegie Institute	1,500,000
Pittsburg, Pa., pension fund	4,000,000
Port Jervis, N. Y., library	20,000
Portmahomack, Scotland, library	3,000
Prescott, Ariz., library	4,000
Richmond, Va., library	100,000
San Diego, Cal., library	50,000
Sandusky, Ohio, library	50,000
Seaboard Air Line Railroad, library	1,000
Sedalia, Mo., library	50,000
Sheboygan, Mich., library	25,000
Springfield, Ill., library	75,000
South St. Joseph, Mo., library	25,000
Steubenville, Ohio, library	50,000
Sterling, library	30,000
St. Louis, Mo., library	1,000,000
Sydney, Nova Scotia, library	15,000
Syracuse, N. Y., library	200,000

Tacoma, Wash., library	50,000
Tacoma, Wash, library	25,000
Tucson, Ariz., library	25,000
Tyrone, Pa., library	50,000
Unionport, Pa., library	50,000
Virginia Mechanics' Institute	1,000
Washington, D. C., library	350,000
Wick, Scotland, library	15,000
Yonkers, N. Y., library	50,000
Endowment Fund, Paddock, Pa.; Duquesne, Pa.; Homestead, Pa., libraries	1,000,000
Miscellaneous gifts, United States	4,428,200
Miscellaneous, Great Britain	250,500
Total	$25,251,552
New York City, libraries (offered)	5,200,000
Grand total	$30,451,552

CONVENTION DATES.

APRIL.

The Southwest Electric and Street Railway Association meets at Houston, Tex., April 19, 1901.

The American Social Science Association will meet in Washington, D. C., some time during the month.

Second annual hand engine muster, open to Massachusetts companies only, April 19, 1901, at Arlington, Mass.

The Volunteer Firemen's Association, of Alabama, will meet in Mobile, Ala., on April 9, 1901. J. H. Turner, secretary, Mobile.

Eastern Public Educational Association will meet in Newark, N. J., April 25-26, 1901. Miss Florence Johnson, 778 High street, Newark, N. J., secretary.

MAY.

The National Civic Federation will meet at Buffalo, May 23-24, 1901.

Exempt Firemen's Association of New Jersey, at Bayonne, N. J., May 15, 1901.

The American Society of Mechanical Engineers meets at Milwaukee in May, 1901.

Georgia and Alabama Volunteer Firemen's Association will be held at Cedartown, Ga., May 15-16, 1901.

The Municipal League of Ohio will meet in Cleveland, O., on May 14-16. Dr. S. O. Giffin, secretary, Columbus, O.

Connecticut State Firemen's Association, eighteenth annual convention will be held May 21-22, 1901, at Hartford, Conn.

National Municipal League, Hon. Clinton Rogers Woodruff, secretary, Girard Building, Philadelphia, will meet in Rochester, May 8-10, 1901.

National Conference of Charities and Corrections will take place in Washington, D. C., in May 9-15. H. H. Hart, Unity Building, Chicago, Ill.

National Electric Light Association will be held May 21 to 23, 1901, at Niagara Falls, N. Y. Secretary, Geo. F. Porter, 120 Liberty street, New York.

JUNE.

The American Park and Outdoor Art Association will meet in Minneapolis, Minn., in June, 1901.

Firemen's muster at Springfield, Mass., will be held under auspices of the Veteran Firemen's Association, June 20, 1901.

The American Institute of Electrical Engineers meets at Buffalo, June 10, 1901. Ralph W. Pope, 26 Cortlandt street, New York, secretary.

American Water Works Association, Peter Milne, C. E., secretary, will be held in New York City during the week beginning June 17, 1901.

The National Social and Political Conference will take place in Detroit, Mich., June 28-July 2, 1901. D. J. Meserole, secretary, 160 Joralemon street, Brooklyn, N. Y.

The American Society of Civil Engineers will meet at Niagara Falls, June 25-28, 1901. Charles Warren Hunt, 220 West Fifty-seventh street, New York City.

The Canadian Electrical Association meets at Ottawa, Ont., June 19-21, 1901.

League of Cities of the Third Class of Pennsylvania will hold its second annual session at Erie, Pa., June 26-28, 1901.

JULY.

The American Library Association will meet in Waukesha, Wis., on July 3, 1901.

The Trans-Mississippi Congress will meet in Cripple Creek, Colo., on July 17-21.

Nebraska State Firemen's Ninth Annual Convention and Tournament will be held at Fremont, Neb., July 16-18, 1901.

AUGUST.

The National Firemen's Association meets at Buffalo in August, 1901.

"Municipal Day" will be observed at the Pan-American Exposition, August 26, 1901.

League of American Municipalities will hold its annual meeting at Jamestown, N. Y., August 21-24, 1901.

New York State Firemen's Convention and Firemen's week at the Pan-American Convention, August 19-24, 1901.

The American Society of Municipal Improvement meets at Niagara Falls in August, 1901. D. L. Fulton, Allegheny, Pa., secretary.

American Florists' and Ornamental Horticulturists' Association will meet in Buffalo, N. Y., on August 20-24, 1901. William J. Stewart, secretary, 67 Broomfield street, Boston, Mass.

SEPTEMBER.

The Glasgow Engineering Congress, Glasgow, Scotland, will be held in September, 1901.

American Public Health Association will meet in Buffalo, N. Y., September 17-20, 1901. Dr. C. O. Probst, secretary, Columbus, O.

OCTOBER.

Western Gas Association will meet in Louisville, Ky., in October.

Pennsylvania State Firemen's Convention and Tournament will be held at Philadelphia, October 1-4, 1901.

BRITISH TRAMWAY STATISTICS.

A PARLIAMENTARY paper issued lately shows that of the 177 tramway undertakings in the United Kingdom seventy belong to local authorities. The total length of the lines open for traffic is returned as 1,177 miles, and is almost equally divided between single and double line systems. The total expenditure on capital account had amounted to nearly £21,750,000 up to June 30 last, and other statistics relating to the twelve months ended on that date show the number of horses employed in connection with the undertakings to have been 37,480, the number of locomotive engines 558, the number of cars 6,410, the total number of passengers carried in the year 1,065,000,000, the gross receipts £5,445,620, and the working expenses £4,075,352. By way of comparison, it may be noted that at the end of the first half of 1878 only 269 miles of tramways were open for public traffic in the United Kingdom, the capital expended up to that time was less than £4,250,000, and the number of passengers carried in twelve months was 146,000,000, while the gross receipts for the year amounted to £1,099,270 and the working expenses to £868,315.

Department of Public Safety

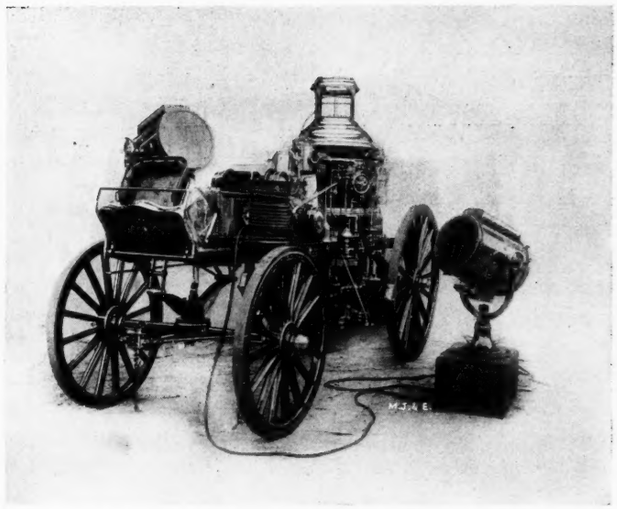
FIRE POLICE HEALTH

GREATEST FIRE DEPARTMENT IN THE WORLD.

IT would naturally be supposed that London had the greatest fire department in the world, but such is not the fact, for that honor belongs to the metropolis of the New World. Edward F. Croker, son of Richard Croker, leader of Tammany Hall, is at the head of the New York department, and is the youngest chief the city ever had. During his term of office there have been many improvements due to his personal effort, one of which was the installation of a portable search-light to be used outside, and more recently one for inside use at a fire. He has been generally acknowledged as an efficient chief, and is heartily in favor of progressive methods of fire fighting, for which reason he is extending the use of the rubber tire and the roller bearing axle on the heavy apparatus of the department.

The two heaviest engines in the service are fitted with

THREE-STREAM ENGINE—NEW YORK FIRE DEPARTMENT.



PORTABLE ELECTRIC SEARCHLIGHT—NEW YORK FIRE DEPARTMENT.

rubber tires, and, although they are located in the busiest sections of the city and are called upon to make an average of forty runs per month over some of the roughest pavements in the world, "they are good for ten years' more of service," said one of the captains. The engines were built by the La France Fire Engine Company, of Elmira, N. Y., and the tires made by the Consolidated Rubber Tire Company, of New York City. Captains Walker and Graham, the former a Bennett Medal man, are in charge of the two engines and are among the bravest of the brave. Captain Walker saved the life of a woman in a severe fire at the risk of his own, in 1893, for which the medal was presented to him.

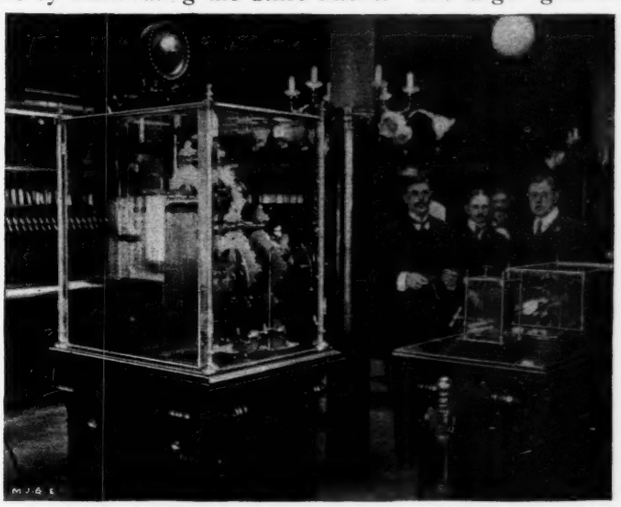
Both captains agreed with the chief, that the rubber tires were a great success, and said: "Before the rubber tires were applied to these monster engines they had to be run into the repair shop three times a year, and we always had to look them over after every heavy run, never failing to find bolts and valves to tighten up and readjust because of injuries sustained in traveling over the rough pavements and swinging out of the car tracks. Such experiences, now that the engines have been fitted with the rubber tires, are a thing of the past."

The engines have been fitted with a patent brake through the enterprise of Chief Croker, which enables the driver to stop them within their own length when going at full speed. This appliance has been the means of preventing collisions with all sorts of obstacles and has saved many lives, both of men and horses.

The "Boss Truck" of the department is located at Station No. 16, and is in charge of Captain Kelley. It was built by The Gleason and Bailey Company, and is fitted with the Grant roller bearing axle, and the rubber tires were made by the Consolidated Rubber Tire Company.

The most novel feature of the department's equipment is the portable search light. Although it was built by the La France Fire Engine Company and equipped by the Rushmore Dynamo Company, Jersey City, N. J., it was constructed and equipped according to the ideas of the chief himself. It has a capacity of eighty volts and a lamp current of thirty-four amperes. The lamps can be removed 200 feet from the engine, and the lenses so arranged as to show up a seven story building twenty-five feet in width.

On first thought it would seem a trifle paradoxical that a fire company should be obliged to hunt for a fire with a search light, but already, although it has been in use but a short time, it has displayed its usefulness in saving lives and assisting the firemen to approach nearer to the seat of the fire by illuminating the dense smoke. The large lights for outside use have been so helpful that the chief is now having three smaller ones for inside use constructed. The New York department has the only search light in the world which is used for fire purposes.

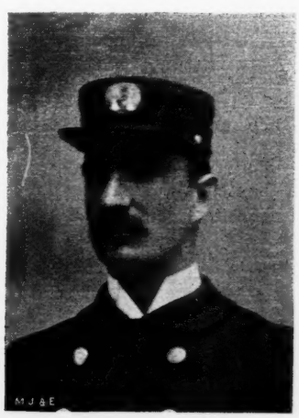


HEADQUARTERS NEW YORK FIRE ALARM TELEGRAPH

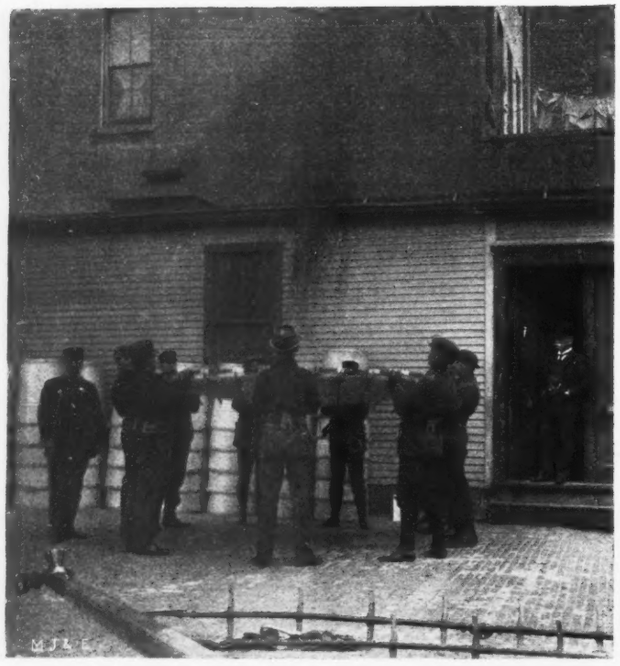
There is no other fire department which treats the rank and file with greater generosity than that of New York City. The ordinary fireman receives sixty-four days off-time each year, exclusive of the sick-time, and he receives full pay in each instance. The average number of days lost to the department, on account of sickness and accident, during the years 1899 and 1900 amounted to 15,000. The average salary of the fireman is $1,200 a year, and after twenty years of service he is retired on half-pay of the rank he held in the department. In case of death his widow is pensioned, and besides an insurance if $1,000 is paid to the widow immediately after his death.

It was not so far back in the last century that the only method of giving an alarm of fire was with the old-fashioned gong in a high tower with the minor assistance of the night watchman and the citizens who ran along the streets crying,

CAPT. JOHN WALKER,
A Bennett Medal Man.



CAPT. M. E. C. GRAHAM,
New York Fire Department.



THE SHADOW OVER THE LIFE NET REPRESENTS A MAN IN THE ACT OF JUMPING INTO THE NET, WHOSE FALL WAS TOO SWIFT FOR THE CAMERA TO CATCH—LIFE SAVING TRAINING SCHOOL—NEW YORK FIRE DEPARTMENT.

"Fire! Fire!" in order to get out the volunteer fire department. To-day it is realized as it was not in those days, that the first five minutes of a fire is the important period to the fire fighter, and for that reason the most perfect apparatus in the world is employed not only to give the fire alarm to the various companies, but also to detect it. Many large business houses and a large per cent. of the hotels, as well as many private residences, are fitted with the Montauk Multiphase Detecting Wire, which is so made that a rise of temperature above the danger point will send in an alarm to the nearest fire company, which is of the utmost importance to the efficiency of a department. But after the receipt of an alarm it is important that it be transmitted to various companies in the shortest possible time and without mistake. In this work the department would be well nigh helpless without the assistance of the Gamewell Fire Alarm Telegraph.

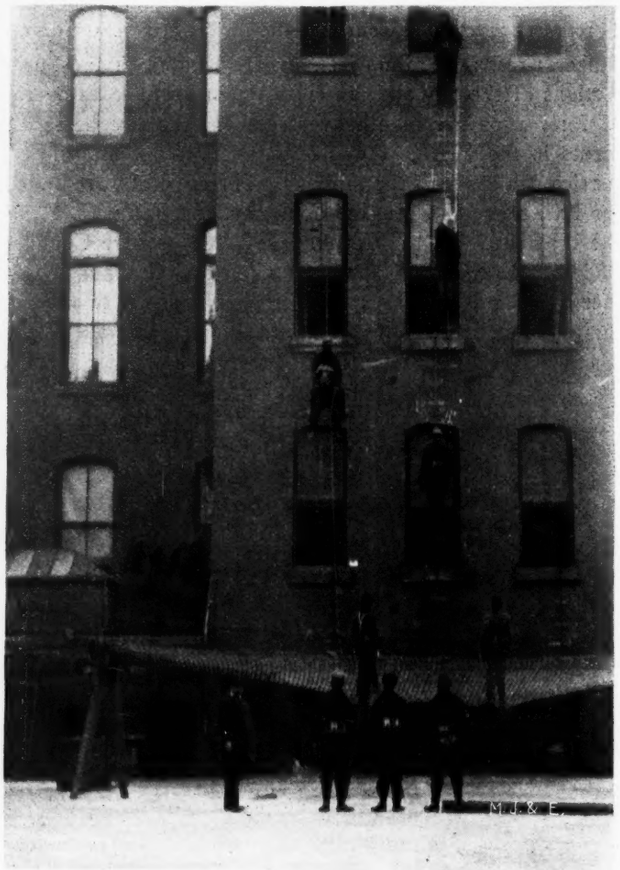
As might be expected, the New York department is equipped with the largest fire alarm telegraph system in the world, which was constructed by the Gamewell Company many years ago and improved at various times and brought down to date. The system is in charge of Henry F. Blackwell, Jr., who is Chief Croker's first assistant.

For several years the size of the department has made a training school, where new men could be broken in to the service, a necessity. Here the candidate for membership in the world's greatest fire department is put through a course of sprouts, for weeks, before he is entrusted with any responsibility, and when he is graduated he is not only a trained fire fighter, but a heroic life saver.

The exercise and training makes a perfect athlete of him. He can swing from one window to another on the same floor; use the scaling ladder with exceeding rapidity to climb up the front of a building, hundreds of feet high, and, if necessary, carry a man or woman down the scaling ladders to a place of safety.

Henry W. McAdams is the chief of this department training school, and has been in this work nineteen years, during which time he has trained 25,000 men for the service, and has never had but two accidents out of that number. The fame of this training school has attracted the departments of other cities, and men have been sent from various cities to take the course of training in order that they could return and establish a similar school in their home departments. Among the cities doing this work are Elmira, Syracuse and Charleston.

Among the devices used in this training school is the life saving net. This is a huge net, constructed of strong material and used in emergency cases to permit people to jump from burning buildings where they cannot be reached by the ladders. The members of this school are not only taught how



USING SCALING LADDER—LIFE SAVING TRAINING SCHOOL—NEW YORK FIRE DEPARTMENT.

to hold the net for others to take the leap, but they are obliged to take the jump from some high point themselves. These nets are constructed at Greenfield, O., by the Browder Life Saving Net Company.

Los Angeles, Cal., is at present taking steps toward establishing a fireman's relief and pension fund, as provided by a bill recently passed by the Legislature. Under this act the fire comissioners will constitute the board of trustees of the fund, and the city treasurer will be ex-officio treasurer of the board. The funds necessary are to be raised by direct taxation, except that the firemen may add to the fund in any way they may see fit.

FIRE STATISTICS.

TABLE NO. 1.

Cities.	Area, sq. miles.	Population.	No. of alarms.	Total no. fires.	Confined to building.
Albany, N. Y.	10.72	94,151	674	674	..
Atlanta, Ga.	11.00	89,872	384	325	..
Bridgeport, Conn.	13.40	70,996	160	152	150
Cambridge, Mass.	6.53	91,886	299	299	288
Camden, N. J.	8.78	75,935	141	141	138
Charleston, S. C.	5.00	55,807	94	94	92
Dayton, O.	15.00	85,333	367	367	..
Des Moines, Ia.	54.00	62,139	411	411	410
Duluth, Minn.	64.00	52,969	167	158	153
Elizabeth, N. J.	9.29	52,130	94	94	92
Erie, Pa.	7.13	52,733	184	184	182
Evansville, Ind.	6.00	59,007	240	240	189
Grand Rapids, Mich.	18.00	87,565	438	427	426
Harrisburg, Pa.	5.83	50,167	73	73	71
Hartford, Conn.	17.29	79,850	..	..	..
Hoboken, N. J.	1.50	59,364	202	202	198
Kansas City, Kan.	15.00	51,418	259	259	243
Lawrence, Mass.	7.15	62,559	172	172	170
Lowell, Mass.	12.39	94,969	366	366	359
Lynn, Mass.	11.33	68,513	403	392	383
Manchester, N. H.	33.90	56,987	190	190	190
Nashville, Tenn.	9.35	80,865	261	240	219
New Bedford, Mass.	19.33	62,442	169	169	169
Oakland, Cal.	32.00	66,960	172	172	169
Peoria, Ill.	5.00	56,100	332	332	314
Portland, Me.	18.25	50,145	217	217	217
Portland, Ore.	40.00	90.426	286	262	..
Reading, Pa.	6.19	78,961	81	81	76
Richmond, Va.	5.50	80,050	305	302	295
Salt Lake City, Utah.	51.24	53,531	131	131	126
San Antonio, Tex.	36.00	53,321	150	150	150
Savannah, Ga.	5.10	54,244	238	238	225
Seattle, Wash.	48.00	80,671	227	227	225
Somerville, Mass.	4.21	61,643	180	180	174
Springfield, Mass.	38.53	62,059	205	205	205
Trenton, N. J.	4.94	73,307	141	141	139
Troy, N. Y.	5.26	60,651	220	220	219
Utica, N. Y.	10.00	56,383	170	170	170
Wilkesbarre, Pa.	4.85	51,721	84	84	83
Wilmington, Del.	10.18	76,508	145	145	..

TABLE NO. 2.

Cities.	Total value involved in fires.	Total loss thereon.	Total insurance thereon.	Total insurance loss.	Loss per capita.
Albany, N. Y.	.....	$338,498	$2,607,566	$283,122	$3.00
Atlanta, Ga.	$2,481,055	66,762	1,733,280	.....	..
Bridgeport, Conn.	.....	.....	1,446,485	82,125	1.14
Cambridge, Mass.	858,712	232,985	623,210	154,704	1.68
Camden, N. J.	683,058	59,330	429,700	51,418	.67
Charleston, S. C.	453,875	29,575	320,750	26,951	.48
Dayton, O.	2,722,215	85,894	1,240,775	82,573	.96
Des Moines, Ia.	2,431,770	349,537	935,423	.....	..
Duluth, Minn.	.....	245,754	1,632,515	.....	..
Elizabeth, N. J.	500,000	39,077	384,500	31,055	.59
Erie, Pa.	.....	53,526	825,532	.....	..
Evansville, Ind.	.....	65,864	398,682	.....	..
Grand Rapids, Mich.	2,348,870	123,162	1,210,514	103,895	1.18
Harrisburg, Pa.	373,300	15,451	201,880	10,129	.20
Hartford, Conn.	.....	.....	.....	.....	..
Hoboken, N. J.	1,919,625	107,097	122,075	58,200	.98
Kansas City, Kan.	10,912,790	211,243	5,584,594	186,550	3.62
Lawrence, Mass.	622,754	39,866	503,650	37,799	.60
Lowell, Mass.	2,522,649	106,408	2,056,882	82,210	.86
Lynn, Mass.	1,088,306	57,389	959,965	54,622	.70
Manchester, N. H.	683,058	59,330	429,700	51,418	.90
Nashville, Tenn.	696,720	256,707	580,600	213,923	2.64
New Bedford, Mass.	.....	40,718	219,575	.....	..
Oakland, Cal.	1,061,140	41,777	710,549	40,297	.60
Peoria, Ill.	.....	52,840	905,625	52,850	.94
Portland, Me.	2,054,909	147,625	811,710	115,213	2.29
Portland, Ore.	.....	171,684	1,887,155	142,217	1.57
Reading, Pa.	.....	333,533	293,265	298,675	3.78
Richmond, Va.	.....	47,265	953,550	47,345	.59
Salt Lake City, Utah.	1,716,895	35,093	641,655	24,963	.46
San Antonio, Tex.	717,500	.....	310,500	72,524	1.36
Savannah, Ga.	2,386,235	153,599	.....	.....	..
Seattle, Wash.	7,098,725	193,337	3,843,235	169,246	2.09
Somerville, Mass.	368,950	48,721	249,900	48,671	.78
Springfield, Mass.	831,251	104,144	741,084	94,693	1.54
Trenton, N. J.	.....	23,583	.....	14,035	.19
Troy, N. Y.	.....	.....	.....	125,000	2.06
Utica, N. Y.	.....	56,484	.....	51,485	.91
Wilkesbarre, Pa.	.....	.....	45,900	4,615	.09
Wilmington, Del.	.....	.....	.....	.....	..

BOSTON'S AUTOMOBILE ENGINES.

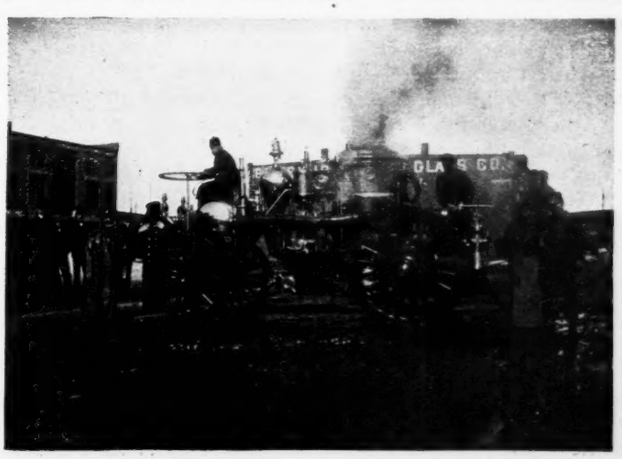
THROUGH the courtesy of Greely S. Curtis, Hydraulic Engineer, of the Boston Fire Department, the MUNICIPAL JOURNAL AND ENGINEER is enabled to give its readers an illustrated description of the two automobile fire engines now in service in that department. He writes:

"Engines 35 and 38, shown in accompanying illustrations, were built for the Boston department in 1897, by the Manchester Locomotive Works, and were accepted in April and December of that year, and have been in continuous service ever since. They are much heavier than horse-drawn engines, weighing 17,600 pounds, or nearly nine tons each. Nevertheless, they are easily handled and can be placed in position at a hydrant with greater ease than a horse engine. They are under control at all times, and, when the streets are clear, they are able to run away from their accompanying hose wagons.

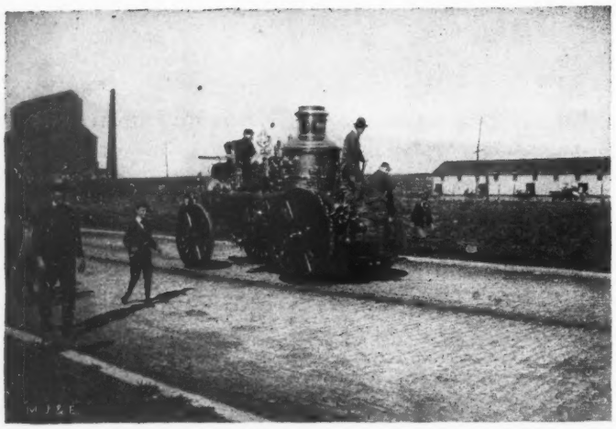
BOSTON'S AUTOMOBILE ENGINE NO. 35, STANDING.

"At fires they throw on an average about 870 gallons of water a minute, or 52,200 gallons per hour, while horse engines average less than half that amount as a rule, although when playing two streams at serious fires the latter play between 500 and 600 gallons. These are average figures. At tests the self-propellers have played over 1,500 gallons a minute, or 90,000 gallons an hour, as against about 1,000 gallons by a first size horse engine.

"The value of the propellers, as fire fighters, is best shown at hot and extensive fires, where their powerful streams from one and three-quarter-inch or two-inch nozzles have immensely more effect than the usual one and a quarter-inch streams of other engines. In this department the policy is to hold them as a first reserve. They answer



BOSTON'S AUTOMOBILE ENGINE NO. 38, STANDING.



BOSTON'S AUTOMOBILE ENGINE NO. 38, RUNNING HALF SPEED ASTERN.

second alarms from boxes in the dangerous district, and, so far, no fire has continued to spread to other buildings after their arrival upon the scene. Engine 35 responds to the box on the top of Beacon Hill on the first alarm, as it is considered a more reliable hill climber in all weathers than horses are.

"These engines have required very slight repairs since they were put in service, the chief expense being for spur tires. The spurs are iron rivets, and they have to be renewed about twice a year."

EXHIBITION OF FIRE APPARATUS AND SUPPLIES.

At the last State convention of the Pennsylvania Firmen it was determined to have a large exhibit of apparatus and supplies. As the next session of this important association will be held in Philadelphia, from October 1-4, 1901, there will be a fine opportunity for manufacturers and dealers in the fire field to arrange for a fine exhibit to their profit.

Secretary Frank B. Bosch has asked for the co-operation of the MUNICIPAL JOURNAL AND ENGINEER in haking this fact well known, and to obtain a full representation of the principal firms. All communications regarding the matter should be adressed to Secretary Bosch, 3126 Fontain street, Philadelphia, Pa. For the benefit of our readers, as well as the dealers and manufacturers, the instructions of the secretary are given, as follows:

"We desire to state that ample space will be provided to properly show all articles received, and in order that this may be fully carried out we desire an early acceptance from all those intending to exhibit, together with the minimum space desired in square feet, and whether wall or floor space, or both is desired.

"Where a practical working test or illustration of any appliance is desired, we will, as far as we are able, furnish facilities for the same.

"Articles for private as well as municipal protection are desired, and mayors, chief engineers, councilmen and owners of large factories and buildings will be specially invited to visit the exhibition.

"We trust that you will favorably consider this matter, and advise us not later than May 1st, 1901, of your intention to exhibit and space desired reserved.

"On receipt of this information we will ask for a list of articles proposed to be exhibited, and such of them, if any, as you may want a practical test of, later on shipping directions will be furnished.

"There will be no charge for space.

"Exhibitors will be requested to furnish this committee not later than September 25, 1901, with a brief written statement covering the merits claimed generally and specially for their exhibit, and this committee will ask leave to print in the proceedings of the convention such claims."

FIRE DEPARTMENT ITEMS.

—The latest device in water towers has just been added to the Washington, D. C., Fire Department.

—Augusta, Ga. is soon to begin the construction of a new engine house in a part of the city where protection is much needed.

—The firemen at New Brunswick, N. J., are agitating the matter of a salvage corps, and in this they are seconded by the citizens.

—Some of the firemen of Columbus, Ohio, are remonstrating against the assessment for political purposes. The civil service commission has taken the matter up.

—The manufacturers of York have organized an independent fire company, and are about to build a hose, and at their own expense equip it. The secretary of the organization is David E. Small.

—Inspector Robert Howe, of the Canadian Fire Underwriters' Association, evidently considers Montreal's fire equipment not up to the mark, for he makes a sweeping recommendation as to additions.

—The following item reads like news from topsy-turvy land. Fire Company No. 5, of Kansas City, Mo., recently had a fire brought to its door for extinguishment. It was a cable car burning from an over-heated stove.

—Le Roy, N. Y., a place of about 4,000 inhabitants, is discussing the establishment of a modern fire alarm system. City Electrician Miller, of Rochester, has offered to furnish suggestions without charge to the village.

—It is now Chief George A. Wallace, of the Cleveland, Ohio, Fire Department. He succeeds J. W. Dickenson. Chief Wallace has been a member of his department ever since it was organized, and was a volunteer fire man before that time.

—Chief Laner and Superintendent Andrus, of the fire alarm telegraph system, have recently been at work perfecting some details of their system at Columbus, Ohio. They recently made a call on Superintendent Morris W. Mead, of Pittsburg, for some pointers.

—During the year 1900, the Fire Department of Brooklyn, N. Y., had 2,694 fires, as against 2,660 for the preceding year. The total loss on buildings, vessels and their contents for the year 1900 was $2,121,939, as against $3,818,471 in 1899. Thus, with 34 more fires, there was less loss by $1,696,532 than during the preceding twelve months.

—It would seem that the Berlin International Exhibition for Fire Prevention and Fire Protection promises to be a notable affair of its kind. It is to be held in Berlin, Germany, in the months of June and July. Manufacturers of all countries are to be invited to display their fire fighting appliances, and the representatives from fire brigades of all countries are to be brought together.

—York, Pa., is especially proud of its volunteer fire department, and justly so. It is one of the best-equipped departments in the country, and because of the men's fire-fighting abilities York can show a wonderful fire record. During the past year 56 runs, including "still alarms," were made, and the total loss by fire for the year was only $23,000. Two of these fires were in an outlying district recently annexed, where the water pressure was low, and where there was a poorly equipped company. Leaving these fires out of the reckoning York's proper loss for the year was only slightly over $6,000. In the newly annexed district a new engine house is to be built as soon after April 1st as the Councils can take the matter in hand. An appropriation is also to be made for a combination hose and chemical wagon and an engine.

DON'T PAY FOR ANOTHER'S DINNER.

"ORDER what you want; pay for what you order," is the unique way in which the Lackawanna Railroad is advertising its new dining-car service. The aptness of the phrase is apparent when it is understood that the traveler may order from the most complete menu, and yet pay for nothing he does not want. In addition, low-priced club meals are served individually from 35 cents to $1.00, so that table d'hote and a la carte features are virtually combined. All through trains to Buffalo, Chicago and St. Louis are equipped with dining-cars, and the service is admitted to be second to none in the world.

PUBLIC UTILITIES

COMPARATIVE WATER STATISTICS.

In Supplement No. 2, issued with this number of the Municipal Journal and Engineer, will be found a valuable table of comparative water statistics, compiled by Dudley E. Waters, president of the Board of Public Works of Grand Rapids, Mich., covering fifty-one cities of 50,000 population or over.

Mr. Waters strongly favors the introduction of water meters in the system of his city, and in stating only the figures as he has found them he has presented a strong argument for the use of the meters on all services as a means of reducing the amount of water consumed per capita. In Grand Rapids his chart shows there is an average of 13,693,499 gallons of water pumped daily for the use of a population of 87,565, or 156 gallons per capita. There are 10,660 taps and only 1,193 meters in service. A notable comparison is that presented by the Fall River, Mass., figures. They show the town to have a population of 104,863, and to be pumping an average of only 3,580,895 gallons of water daily; the number of taps is 6,873, and there are meters on 6,363 of them. That gives a per capita consumption in Fall River of thirty-four gallons against 156 in Grand Rapids.

On the other hand in towns where meters are not in general use, the average daily per capita consumption as a rule runs higher than in Grand Rapids. For instance, at Buffalo, which has a population of 352,387, 110,000,000 gallons of water are pumped every day. The percentage of meters to taps is .025, and the per capita consumption is 312. The rule is not invariable, some places with few meters having a small per capita consumption, but it can be noticed that generally where meters are used to a large extent the per capita consumption is smaller and the number of gallons pumped through the mains is less.

THE CRUSADE FOR PURER WATER.

There is no more popular nor more important subject connected with civic government to-day than that relating to the purification of the public water supply. At the present time, besides innumerable smaller undertakings, there are in process of construction some of the largest filtration plants the world has ever known.

Philadelphia heads the list, and will expend $16,000,000—some of the papers say $27,000,000—on its filtration plant. Pittsburg, Cincinnati, Louisville, New Orleans and Washington all have large plans looking to the purification of their water supplies under way. Millions of dollars have been appropriated in each of these cities, and all of the improvements will be well advanced before midsummer. The latest filtration scheme involves the construction of the largest mechanical filter in the world.

This plant will be constructed at Little Falls, near Paterson, N. J., by Gillespie Brothers, for the East Jersey Water Company. The plans call for the construction of thirty-two filter beds, each having a capacity of one million gallons daily. These will measure fifteen by twenty-four feet, and contain about three feet of sand or powdered quartz. The bottoms and sides of the beds will be of concrete. The water will be conveyed from the filters to an enormous well for storage. For controlling the inlet valves to the filters a greatly improved method will be adopted. The mechanism will concentrate the levers at a single point in a way that will greatly simplify and facilitate operation. These new works are all to be enclosed in a building measuring 190 by 140 feet, and 65 feet high. The edifice will have concrete foundations and walls. In fact, in the quality of material and the workmanship, as well as in its capacity, the plant will be distinctly superior to anything else in this country. And it is hoped that it may be ready for business by next fall.

BATTLE CREEK WATER-WORKS.

One of the best conducted municipal water plants in the country is to be found in the city of Battle Creek, Mich. The plant is in charge of Superintendent W. W. Brigden, and the excellent administration of its affairs have attracted the attention of the larger cities for years.

Its source of supply is Goguac Lake, 360 acres in area, with a maximum depth of eighty feet, surrounded by a water shed of one and a half square miles. In addition to this the lake can be fed from Minges brook, which has a drainage area of fourteen square miles.

The pumping station is equipped with two Blake compound, duplex, condensing steam pumps, each having a capacity if 2,000,000 gallons per day. The pressure maintained is from sixty-five to eighty-five pounds. The average lift of the pumps is about 104 feet. There is a stand pipe 75 by 18 feet, which has an elevation of 200 feet above the business part of the city. The bonded debt amounts to $80,000, at 4½ and 5 per cent. interest.

CONDENSED STATEMENT FOR 1900.

Total cost of construction to Dec. 31, 1900	$284,835.41
Expended for mains	5,414.25
Expended for service pipe (including taps for paving)	1,954.41
Average cost of service, main to curb	10.00
Length of mains, miles	35.2
Street valves	296
Public hydrants	354
Number of meters and registers in use	1,878
Per cent. of taps metered	78
Per cent. of water metered	44
Number of taps or services, not including taps on account of paving	2,419
Number of Park fountains, public	3
Public drinking fountains	8
Operating expenses	$11,022.72
Expense charged Pumping Account	4,520.53
Cost of coal used	1,664.00
Water pumped, in millions of gallons	372
Average water pumped per day, gallons	1,018,000
Average cost per 1,000 gallons for pumping expense only, cents	1.2
Average cost per 1,000 gallons for total operating expenses, cents	3.0
Average cost per 1,000 gallons for operating expenses and interest at 4½ per cent. on total costs, cents	6.4
Estimated population of city	18,500
Water used per day, per capita, gallons	55
Water used per day, per tap, gallons	421
Level of water in lake below gauge, Dec. 31	10.0
Rainfall, inches	34.63
Annual rainfall in this locality, inches	30
Receipts for water, including advance on application	$20,595.71
Receipts per tap on total number	8.51

Average receipts per 1,000 gallons for metered water, cents	11.3
Average receipts per 1,000 gallons for unmetered water (40 to 45 per cent. of total free or wasted), cents	6.0
Receipts for licenses	$40,000.00
Duty—Coal used while running	34,000,000
Duty—Total coal used	30,000,000

METERS IN USE, DECEMBER 31, 1900.

Kind of Meters.	Register.	Sizes. ⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	Sold.	Rented.	Total in use.
Crown		1,002	77	22	1	14	5	164	957	1,121
Gem		....	...	..	..	..	4	2	2	4
Worthington		2	...	..	..	1	1	1	3	4
Westinghouse		1	1	..	..	..	..	2	....	2
Reg. on Elevator	1	....	...	..	..	..	..	1	....	1
Hersey		1	44	1	..	..	..	9	37	46
Empire		14	4	..	..	..	..	2	16	18
Nash		25	52	..	..	..	..	5	72	77
Thompson		4	179	2	..	..	1	14	172	186
Lambert		11	215	..	1	1	..	21	207	228
Neptune		60	130	1	..	..	..	23	168	191
Total	1	1,120	702	26	2	16	11	245	1,633	1,788

Meter rates, 7 to 13 cents per 1,000 gallons. Minimum annual rate, $3.00.

Meters are sold at cost, or rented at annual charge of 15 per cent. on cost.

All new takers must put on meters and all who change pipes or fixtures or add thereto.

FINANCIAL RESULTS OF OPERATING FOR 1900.

Income from water rates		$20,595.71
Income from rent of meters		3,320.15
Proper charge for use of 354 hydrants	$45,00	15,930.00
Proper charge for city hall, engine house, schools, water troughs, flushing sewers, etc		800.00
Total		$40,645.86
Operating expenses	$11,022.72	
Interest on total cost at 4½ per cent	12,817.59	23,840.31
Net gain by operating, not allowing anything for depreciation		$16,805.55
Surplus in hands of city treasurer	$8,598.14	

AMERICAN WATERWORKS ASSOCIATION.

THE twenty-first annual convention of the American Waterworks' Association will be held in Manhattan, city of New York, during the week beginning June 17 next. It is expected there will be a large attendance present, as very valuable papers will be read and discussed, and the entertainment committee will see that the amusement of the members and the visiting ladies will be amply provided for. Engineers, superintendents, commissioners, registrars, and all officers connected with the waterworks systems of the country should make an effort to be present on the occasion, not only on account of the valuable information on waterworks subjects that will be presented, but also to partake of the enjoyable outing provided for them in the Empire City of the Empire State.

PETER MILNE, C. E., *Secretary.*

The adjourned meeting of the local committee of arrangements of the American Waterworks' Association was held in the Astor House, New York, March 5th, at which there was a large attendance. Lester E. Wood was elected permanent chairman of the committee, and Peter Milne, secretary. On motion it was decided to appoint subcommittees to carry on the work of the convention. The chairman named the following:

HOTEL AND EXHIBITS.

Fred A. Smith, Hersey Manufacturing Company.
F. W. Whitcomb, Neptune Meter Company.
S. D. Higley, Thomson Meter Company.
Murray G. Milliken, H. Mueller Manufacturing Company.
Walter J. Drummond, of M. J. Drummond & Co.

FINANCE.

John C. Kelley, President National Meter Company.
Anthony P. Smith, President A. P. Smith Manufacturing Company.
H. J. F. Porter, Bethlehem Steel Company.
D. W. French, Engineer and Superintendent Hackensack Water Company.
John M. Diven, Superintendent Waterworks, Elmira, N. Y.
Charles A. Moore, of Manning, Maxwell & Moore.
Will J. Sando, International Steam Pump Company.
Charles A. Hague, C. E., New York.

TRANSPORTATION.

Peter Milne, C. E., Secretary, New York.
Joseph L. Wertz, Newark, N. J.
D. C. Toal, *Water and Gas Review,* New York.

ENTERTAINMENT.

William R. Hill, C. E., Chief Engineer Croton Aqueduct Commission, New York.
H. G. H. Tarr, of R. D. Wood & Co.
John S. Warde, Superintendent Waterworks, West New Brighton, N. Y.
Charles A. Hague, C. E., New York.
F. W. Sheppard, *Fire and Water,* New York.
J. A. Tilden, Hersey Manufacturing Company.
Allen Hazen, C. E., New York.
H. J. F. Porter, Bethlehem Steel Company.

On motion of Wm. R. Hill the names of Hon. J. J. Ryan, President Croton Aqueduct Commission, Charles S. Gowen, Division Engineer new Croton dam, and William S. Crandall, of MUNICIPAL JOURNAL AND ENGINEER, were added to the general committee. The following names were also added to the committee: J. A. Tilden, Hersey Manufacturing Company; Joseph L. Wertz, Neptune Meter Company; Allen Hazen, C. E., New York; Walter J. Drummond.

A general discussion took place among the members as to the length of time the convention was to occupy, the days to be devoted to business, and propositions as to entertainments. The prevailing idea was that Monday, June 17, would be devoted to the reception of members, and the first business session would open on Tuesday forenoon, the meeting closing on Saturday with a full day excursion. From the interest manifested in the proceedings, it now looks as if the convention would be the most successful one in the history of the association. It was determined that the full local committee should act as a reception committee.

IMPURITIES IN ICE.

AT a meeting of the Manufacturers' Association of Brooklyn, on March 18th, Wm. P. Mason, Professor of Chemistry of the Renssalaer Polytechnic Institute, of Troy, N. Y., read his technical report on the formation of ice of polluted water.

He substantiates the belief that the formation of ice eliminates impurities to an extent, but found, upon testing samples of ice taken from germ-polluted fields, in the Hudson River, just below the junction of the Mohawk River, that certain disease germs were still alive, and condemned this ice as wholly unfit for use in cooling beverages.

Typhoid germs were not killed, as proved scientifically.

He cited the case of a typhoid epidemic which spread from Schenectady to Albany, the Mohawk River carrying the typhoid germs down to its mouth, polluting the ice formed in the Mohawk, whence the ice supply of the two cities was

taken. In this manner both cities suffered with a typhoid epidemic.

As a general thing, in the formation of ice, the impurities of the water lay nearer the bed of the pond or river, the ice forming on the surface, where the water is purer.

The association is to present petitions to both the State and city health boards, asking that some steps be taken to prevent the polluted ice being sold in this market.

WATER DEPARTMENT ITEMS.

—Oneida, N. Y., is having to contend with an insufficient water supply.

—Newburg, N. Y., has outgrown its present water supply system, which was established some forty-eight years ago. J. James R. Croes has been retained by the Water Commission to report on a proposed new plan.

—The Merchants' Association of New York City, through its Committee on Water Supply, has taken up the systematic study and investigation of the water supply question, which will be inquired into in all its phases.

—Dr. Luke Fleming, the health officer of Tarrytown, N. Y., condemns the water now used, furnished by the Pocantico River Water Company. He says that after rains the water is saturated with dead vegetable and other matter.

—Alderman Kennedy, of Buffalo, N. Y., recently introduced a resolution to do away with water rates and serve water free to the citizens. The resolution, while radical, is nevertheless commanding the attention of the council and aldermen.

—The American Water Works Association, through its committee, has arranged to make the Murray Hill Hotel the headquarters of the association during the coming convention. Members wishing accommodations may either address the hotel management or Fred. A. Smith, 280 Pearl street, New York City.

—Supt. John T. Ahearn, of the Nashville, Tenn., water works, has recently submitted his annual report, which is said to be the most exhaustive ever issued by that department. A big increase of revenue and a reduction of operating expenses are the salient points noted. Superintendent Ahearn strongly recommends the use of meters.

—York, Pa., boasts that notwithstanding the fact that the water supply is in the hands of a monopoly, that the water is exceptionally good and the pressure extraordinary. The city pays only for water used in the various city institutions, but water for fire purposes is supplied free. The pressure at the fire plugs averages from eighty to 110 pounds.

—According to the latest report of the State Board of Health of Massachusetts, there are eighty-two towns and cities in the commonwealth which keep a record of the consumption of water. Some of these cities and towns use meters, others not, but the average daily consumption per capita of these eighty-two municipalities was, in 1899, only forty-nine gallons.

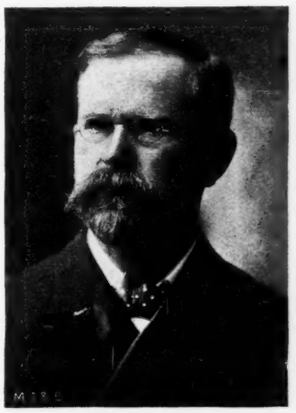
—The annual report of the Water Department of Montreal disclosed that 899,172,811 gallons were furnished in 1899 without meters and 771,240,804 in 1900. This is a considerable decrease, but it is not so great an argument for the "metered" side of the question as one would at first suppose, inasmuch as a number of outside municipalities have ceased to use Montreal water.

—Supt. George T. Ingersoll, of Schenectady, N. Y., is authority for the following comparison between metered and non-metered cities:

Metered.			*Non-metered.*	
Yonkers, N. Y.	40	gals.	Albany, N. Y.	191 gals.
Madison, Wis.	41	"	Cleveland, O.	154 "
Utica, N. Y.	53½	"	New Haven, Conn.	150 "
Fall River, Mass.	35	"	Nashua, N. H.	166 "
Providence, R. I.	53	"	Detroit, Mich.	147 "
Rochester, N. Y.	83	"	Buffalo, N. Y.	195 "
Bangor, Me.	80	"	Schenectady, N. Y.	166 "

WATER SUPPLY OF TROY.

BY PROF. WILLIAM G. RAYMOND, RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.



PROF. WM. G. RAYMOND, Troy, N. Y.

THE city of Troy lies, for the most part, on a long narrow strip of land, rather less than a half mile wide, between the Hudson river and a line of hills rising almost immediately to heights of from 300 to 400 feet and more.

In recent years a considerable area of the higher ground has been improved as a residence district, so that water is now required to be supplied at elevations varying from approximate sea level to about 430 feet above sea level.

The system is divided into three services—low, middle and high. The high service reaches an altitude of about 350 feet.

The low service is supplied with water taken from the Hudson river at a point near the northern end of the enlarged city. The water is pumped through a 30-inch force main, about 16,000 feet, to a small storage reservoir, from which it is dropped into a smaller distributing reservoir, where it enters the distributing system.

The upper and middle services are supplied with gravity water from an enlarged spring lake, and storage water from a drainage area of about two square miles.

The water of the Hudson is of inferior quality, and has been pronounced unfit for domestic use unless filtered.

The gravity supply is a fairly pure and acceptable supply, except that like all water from small cultivated drainage areas it is apt to be roily and unpleasant after rains, there being insufficient storage to provide proper settlement.

The demand of the city has outgrown the supplying capacity of both systems now used, and for some years new works have been under consideration.

The city has now secured the right to spend $1,250,000 in obtaining an additional supply, and has recently awarded contracts for some portions of the work.

The hills lying to the east of the city, and rising to extreme altitudes of nearly 2,000 feet, are well watered, contain

TROY WATER SUPPLY—LONG POND, SOURCE OF SUPPLY.

SECOND POND, GRAFTON—TROY WATER SUPPLY.

many small lakes, and send down several goodly streams, two of which flow directly through the city. These two, the Wynantskill and the Poestenkill, have drainage areas of about thirty-five square miles and eighty-eight square miles respectively, down to the city line, and have been quite extensively utilized for power, the Wynantskill having a fall of about 300 feet, and the Poestenkill a fall of over 200 feet, all within the city limits.

Another stream, the Tomhannock, flows in a general northwesterly direction nearly parallel with the Hudson valley, and empties into the Hoosick river.

The water of the Wynantskill is clear and colorless, but the stream is considerably contaminated by the drainage of several villages through which it flows. The water of the Poestenkill is dark colored and somewhat peaty, though normally less so than the Hudson river water, and it receives very little household drainage. Tomhannock water is clear and colorless and receives very little dangerous drainage. There is only a nominal power development on this stream.

The Tomhannock water being much the best water of the three streams mentioned, it is the most desirable source of supply, but is unfortunately not high enough to supply the upper services. There exists on this stream, also, an almost ideal reservoir site.

The solution of the problem that has been advised and is now in process of development, is to take a supply from the Poestenkill for the higher services and from the Tomhannock for the low service.

Accordingly a drainage area of about sixteen and one-half square miles of a tributary of the Poestenkill, known as the Quackenkill, will be utilized for the high services. This drainage area contains some six or seven small lakes and ponds, the largest, Long Pond, covering about 100 acres; supplying a constant stream of clear, colorless water, free from any contamination.

This lake, which is partly the result of a dam, and two of the others, will at once be improved so as to somewhat increase their storage capacities. At the lower limit of the drainage area a diverting dam will be erected, from which a 16-inch supply main about 32,000 feet long will lead to the present gravity system storage reservoirs. The dam, about fifteen feet high above the bed of the creek, will be of concrete founded on rock for the greater part of its length, and of earth for the remaining portion. The concrete portion is an overfall dam with ogee profile.

A Venturi meter will be placed on the pipe line, as it is desirable to know the quantity of water supplied by the stream. It is believed that weir measurements and meter measurements taken for a period of years after the completion of the works will add much to the knowledge of the relation of stream flow and rainfall on steep drainage areas like this one.

The contract for the dam and for the pipe has been awarded. The pipe is being made, and work on the dam will shortly begin.

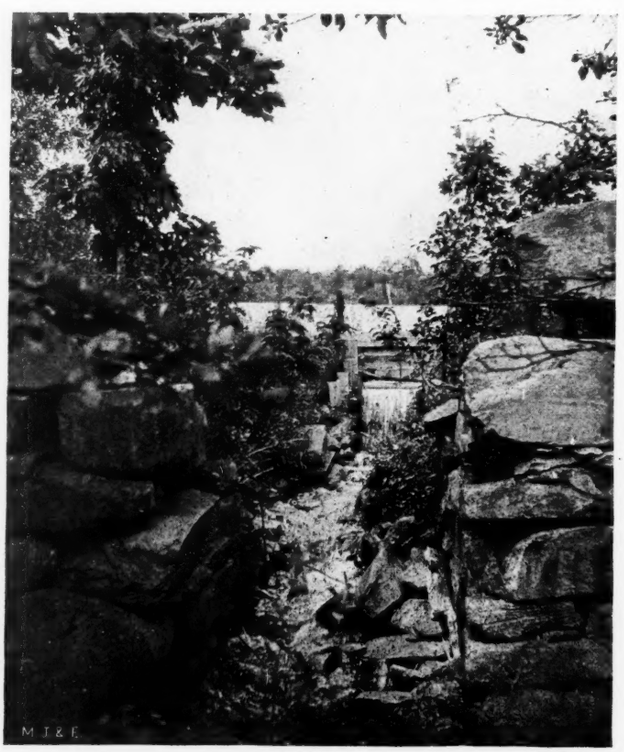
The pipe line will operate under an hydraulic grade of 0.88 per cent. The Tomhannock system is not yet planned in detail. The general plan is as follows:

A reservoir 38,000 feet long will be built, averaging rather more than 2,000 feet wide at the flow line. and capable of impounding about 10,000,000,000 gallons, or about 1,000 days' supply at the present rate of consumption.

The dam forming this lake will be about 60 feet high, of earth with concrete core wall, and probably without any opening through it. It will be about 350 feet to 400 feet long on top.

The spill way will be entirely separate from the dam; a high knoll intervening between the stream to be dammed and a saddle that will be used for a spillway.

About a mile up stream from the dam site the hills between the Tomhannock and Main Hudson valley narrow down to about a mile in width. At this point it is expected



TROY WATER SUPPLY—OUTLET TO MILL POND, GRAFTON.

TROY WATER SUPPLY—SITE OF RESERVOIR.

to take the water from the storage reservoir through a tunnel, made large enough to supply 30,000,000 gallons daily, with the necessary margin. From the mouth of the tunnel some seven miles of pipe will be laid to connect with the present low service reservoirs. The diameter of the pipe is not yet definitely determined, but it will probably be either 30 or 36 inches.

The problem of preparing the bottom of the reservoir is the most serious one at present being considered. To remove all the surface soil to a depth of nine inches or a foot would entail a prohibitive cost. The land is almost all clean farm land, either under cultivation or in pasture. There is very little muck or swanpy ground within the area to be flooded. Several farm houses and outbuildings will have to be removed, and a number of road changes will be necessary.

There will be about 2,000 acres of land and two or three small country grist and saw mills to purchase.

There has been much discussion in the city as to the relative merits of filtered Hudson river water and the gravity supply now proposed. The reasons for adopting this gravity supply rather than river water are these:

While the first cost will be greater, the real cost, including capitalized interest and operating expenses, will be less, which means that the annual tax will be less for the proposed gravity supply than for unfiltered river water.

Filtering may be adopted for either supply: it is known to be absolutely necessary if river water is used, and the need is at least very doubtful if the gravity supply is used.

To filter the gravity supply will be much less costly than to filter the river water.

The gravity supply is a fairly pure water coming from a watershed so within the control of the city that sewage pollution may be entirely prevented, while the river water is at certain seasons little better than largely diluted sewage and factory waste, from which it is impossible to remove all of the dangerous organisms.

The Tomhannock is capable of yielding nearly, if not quite, 30,000,000 gallons daily during the dryest years. The Quackenkill is capable of yielding certainly 8,000,000 gallons, and the city has now a gravity supply good for 1,500,000 gallons at least. So it will be seen that the plans proposed to be carried out will provide, when fully developed, nearly 40,000,000 gallons of water daily.

TROY WATER SUPPLY—UPPER VALLEY OF TOMHANNOCK—SITE OF RESERVOIR.

This will permit Greater Troy's 75,000 people to double in number and still have as lavish a supply of wholesome water as is furnished to any American city.

TROY WATER SUPPLY—THE QUACKENKILL—SITE OF DIVERTING DAM.

PRACTICE OF PARK SUPERINTENDENTS.

—It is only forty-five years ago the first acre was bought for a public park.

—Refuse salt from packing houses at $2 per ton is suggested as a practical berbicide.

—A blaze from a gasoline torch has been mentioned as a possible exterminator of park weeds.

—Park maintenance now gives employment to over 10,000 men at an annual cost of over $8,000,000.

—It will not be long in this country before park valuation will equal the capital of the steel trust.

—The tramp and dog questions seem to be the ones that add most gray hairs to the heads of park keepers.

—Cinder walks, with a top dressing of broken stone and its screening, make a park walk highly recommended.

—It is suggested that the word "police" be dropped as to parks, and the word "keepers" or "guards" substituted.

—To successfully raise trees and shrubs near the seashore, a shelter of coarse poplars or willows should first be reared.

—The *Quercus Paulustris,* or pin oak, has been suggested as a desirable tree to break the monotony of too many maples.

—The concensus of opinion among park superintendents is to put up with small depredations rather than have a large police force.

—Cinders from either hard or soft coal are used quite extensively for park walks. They are particularly desirable for under drainage.

—Salt water for sprinkling driveways is recommended on the ground that it does not dry out as quickly and keeps down vegetation.

—A stone color is suggested for bridges, fences, settees, etc., as not being so sombre as the dark bronze green used so much in the past.

—One having some experience claims that the pin oak grows in height fully as quickly as the maple, and that it affords shade much sooner.

—Tar concrete walks at one time averaged twenty years of usefulness, but nowadays, owing to the deterioration of tar, their life is barely five years.

—Coal cinders are particularly desirable as ballast behind retaining walls and bulkheads. They act as an elastic medium between the source of pressure and the retaining structure.

—It is suggested from Concord, N. H., that hydrangea, B. G., does particularly well in the vicinity of salt water. That with requisite care blooms over a foot in diameter may be had. Another seashore park decorator is the North Carolina poplar.

—To exterminate the elm beetle smooth the trunks of trees and kill the pest while lying dormant at their base. The larvæ hatch out early in July, and after feeding on the leaves crawl toward the ground. It is there they hide in crevices and under bark and at the foot of the trees.

—Mr. John H. Hemminway, park superintendent of Worcester, Mass., has discovered that the common red squirrels make raids upon the nests of birds for their young. However, Park Superintendent Henry Frost, of Haverhill, Mass., suggests that the squirrel is as valuable a park feature as the birds and at greatest do not work undue havoc.

PARKS AND PLEASURE GROUNDS OF LONDON.

THE wilderness of houses of the world's metropolis would be a dreary place if it were not for the bright green parks and breathing places which break the monotonous sameness at various points. The task of providing gardens for the gardenless has been a matter that has had earnest consideration at the hands of the London County Council for many years. While much was done for the park system by the old Metropolitan Board of Works, yet the County Council, since the park system has been under its charge, has done more. No opportunity has been lost for securing parks for the people, and during the last ten years the acreage of London's municipal parks and recreation grounds has been almost doubled.

More than this, new features and means of pleasure for the people have been added, and the parks have been made

DINING PAVILION, REGENT'S PARK—LONDON PARKS.

BATHING POOL, VICTORIA PARK—LONDON PARKS.

models both for the diversity of the pdeasures provided and for the special consideration given to the children.

Each park has characteristics of its own and some of them have unique histories. Battersea Park is famous for its subtropical gardens, yet it was once the scene of swampy marshes and rowdy orgies. The gardens were laid out thirty years ago. Besides being a source of pleasure, they are made a means of education, and a corner for students to pursue their studies in connection with technical education has been provided. In this park an Alpine garden may also be found, with snow plants, and other of nature's gems found on snowclad peaks.

Whereever it is possible the natural beauty of the park has been left undisturbed. Bostall Wood is one of the parks which has been left in almost its primeval state, as no embellishment was needed. It would be difficult to find a more delightfully wild and wooded spot with its extensive stretches of pine, larches and birches, its thick undergrowth of holly and its gorges. It is the favorite picnicing ground of the entire system.

When the County Council took charge of the park system in 1889 it had under its control forty-three parks and open spaces, with a total of 2,578½ acres, and an outdoor permanent staff of 278, while at the present time it has control of eighteen parks, thirty-nine gardens and playgrounds, and thirty open spaces, a total of eighty-seven places, having an extent of 3,814¼ acres, and a staff of 765 permanent men, with temporary men varying in number from 100 upwards.

The London parks are also noteworthy for the diversity of the amusements they provide. Exhibitions of birds, animals and aviaries are to be found in eight of the larger parks. Deer, goats, guinea pigs, etc., are to be found at several other parks.

The provision which has been made for sports of various kinds has been most liberal. Special gymnasiums for the children have been placed in most of the principal parks, and at Victoria Park huge sea-sand pits have been provided for the enjoyment of the poor East End children. Provision is made for the playing of bowls, cricket, croquet, football, hockey, hurling, lacrosse, lawn tennis, quoits and even golf. During the winter months every precaution has been taken

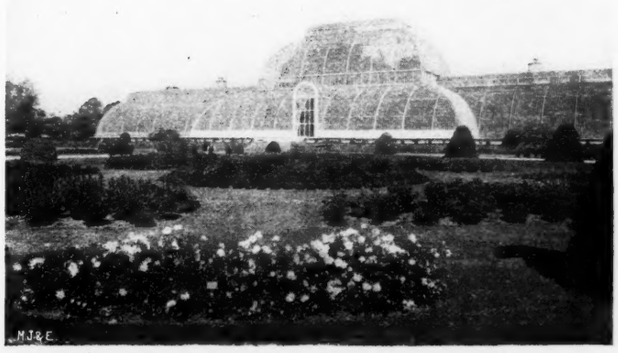
OLD CEMETERY USED AS PARK—LONDON PARKS.

to secure good skating surfaces on the lakes; and in the summer time boating and swimming are encouraged. The Council earned considerable popularity in its management by insisting that reasonable prices should be charged at all the refreshment houses in the parks.

In addition to the municipal park system the Council is responsible for the maintenance of forty-three parks and recreation grounds covering an area of 2,600 acres. Besides these parks the city enjoys the advantage of ten large commons, the forest at Epping and parks on the outskirts, which are maintained by the City Corporation out of "city cash" and the funds derivable from metage on grain. Then there are the half-dozen magnificent Royal parks; while, scattered throughout London, and not included in the above enumerations, are a large number of small green spots, maintained principally by the local authorities.

During the season of 1900 more than 1,200 clubs sent in applications for cricket pitches. About 15,000 games of cricket were played during the season. There are 466 tennis courts at the various parks and open spaces, and nearly 50,000 games were played during the year.

Football is played from October 1 to March 13, and more than 8,000 games were played last year.



CONSERVATORY, KEW GARDEN—LONDON PARKS.

The forty-five ponds suitable for skating have a total area of sixty-eight acres.

The privilege of supplying refreshments is sold on contract and the Council receives a revenue of about £2,000 from this source. Contractors are bound to adhere strictly to the schedule of prices fixed by the Council, of which the following are a few examples:

Tea, in cup, per half-pint cup, with milk and sugar	1 d.
Tea, fresh made, per pot, for two persons	3 d.
Coffee, per half-pint cup, with milk and sugar	1 d.
Cocoa, per half-pint cup	1 d.
Chocolate, per half-pint cup	2 d.
Milk, per tumbler	1 d.
Teapot, teacups, saucers, spoons and plates (hire of) per person	½d.
Hot winter drinks (non-alcoholic) per half-pint tumbler	1 d.
Soda and milk, per tumbler	1½d.
Ginger beer, per bottle	1 d.
Lemonade, per large bottle	1½d.
Lemonade, per small bottle	1 d.
Rolls	1 d.
Bread and butter, per slice	½d.
Cakes, each	¼d., ½d., 1d. and 2 d.
Sandwiches, each	2 d.
oiled eggs, each	1½d.
Sausages, each	2 d.
Ices	1d. to 4 d.
Cigars	1d., 2d., 3d. and 4 d.

GOLF LINKS, HIGHGATE WOODS—LONDON PARKS.

Tobacco, per oz	4d., 5d. and 6 d.
Chops	7 d.
Steaks	8 d.
Potatoes	1 d.

CO-OPERATIVE TELEPHONES.

THE co-operative telephone system at Grand Rapids, Wis., seems to thrive. The city has enjoyed a service that is not only efficient, but remarkably cheap. The company was organized in 1896, with a capital stock of $5,000, divided into shares of $60 each. Any person could become a member of the combination by subscribing for one or more shares and by leasing one telephone for each share of stock. The company was thus to be controlled by the telephone renters and for their sole benefit. The company now rents 300 telephones and has increased its capital stock to $10,000. The rents are uniform, being established at first at $2.50 per month for business houses and $1.50 for residences, and after six months a dividend of 1 per cent. a month was declared. After eighteen months the rates were reduced to $2.25 and $1, and the dividends were increased to 1½ per cent. a month. The net cost of service to each of the renting stockholders shows a cost of $24 a year for business houses and $7 per year for residences.

THE restaurants in the London parks are under the control of the London County Council, the governing body of Greater London, which fixes the schedule of prices on all articles sold.

There are two books upon municipal affairs that should be in the hands of every mayor in the United States, whether he be at the head of a city with a million population or of one thousand; viz., "Municipal Government in Great Britain" and "Municipal Government in Continental Europe," by Dr. Albert Shaw, editor of *The Review of Reviews*, and published by The Century Company, Union Square, New York. While, of course, it would be absurd to think that many of the suggestions in these works could be put in practice in all American cities, yet it is true that many times valuable suggestions are obtained from the reading of such books that otherwise would be lost. The books contain 385 and 505 pages, respectively, and a vast amount of information is made thoroughly available by a well built index. The volumes may be had for $2 each, either from the publishers direct or through the MUNICIPAL JOURNAL AND ENGINEER.

It may be well to say right here that when you are in need of the latest information upon any subject relating to municipal affairs, you can obtain the "where and how" to get it, at what price and on the shortest notice, by addressing a letter to the Editor.

* * *

P. S. King & Son, of London, have just published an instructive monograph of sixty-four pages, upon "Modern Methods of Saving Labor in Gas Works." It is prepared to meet the needs of the manufacturer of gas, whether by the municipality or the private corporation. With its lucid presentation of the subject and the sixty illustrations showing the modern machinery employed and the manner of its installation, it cannot fail to be of value to the maker of gas. It sells for 3s. 6d., postage prepaid.

* * *

The Century Company, Union Square, New York, has published a number of books which, to be read by the municipal officer, especially by the chief executive, the legislators or the heads of departments, would broaden the individual's horizon and increase his usefulness to his constituents. Among these works may be mentioned, "The Scholar and the State," by Bishop Henry Potter, of New York. This is a collection of seventeen addresses upon questions quite as closely related to the affairs of the city as those of the State. Bishop Potter is incapable of producing an uninteresting book, and the 335 pages of this book will hold the attention of the earnest reader from start to finish. It sells for $2, postage prepaid.

* * *

"The Public School System of the United States," by Dr. J. M. Rice, is another Century publication, and should find a place on the shelves of the superintendents of instruction in all our cities, because it contains the practical observations and criticisms of a practical man, who obtained his information first hand, by a tour of the leading cities and a careful inspection of the various schools. The story is told in 308 pages and is well illustrated. The practical suggestions it contains are worth several times the price charged; $1.50 postage prepaid.

* * *

"Electricity for Everybody: Its Nature and Uses Explained," is a popular work prepared for the lay reader's use by Philip Atkinson, A. M., and published by The Century Company. It treats the subject thoroughly, but without the introduction of highly technical language. The simplest kind of electricity, as well as the latest developments in this ever growing science is treated in a comprehensive manner. Its perusal, by the average mayor, would enable him to obtain a better view of the electric lighting question and a consequent better service for his city. It contains 266 pages, is well indexed, and sells for $1.50.

* * *

The "Cosmopolis City Club," by Dr. Washington Gladden, was written some years ago, and was first given to the public in the form of a serial in the *Century Magazine*. It has 135 pages and is full of hard common sense. It tells how not to conduct a city reform movement as well as how it can best be done, in a semi-story form, which entertains and instructs at the same time. If the average reformer would read, inwardly digest and put in practice the suggestions in this small book, it would be much better for his cause. A dollar sent to The Century Company will bring it to your address, carriage prepaid.

* * *

To the person who is interested in charitable work in the great city of New York, the "New York Charities Directory" is indispensable. It contains a complete list of the multitude of charitable organizations which are at work, covering the entire field, and looking after every human need, suffering and reform. One dollar is all that it costs to have it sent to any address. It is published by The Charities Organization Society, New York.

* * *

Another work which all persons who are interested in municipal affairs, whether as an official or citizen, will find profitable reading, is that which has been edited by Prof. Edward W. Bemis, on "Municipal Monopolies," which has just been thoroughly revised and brought down to date. No municipal library will be complete without this book. It is a collection of papers by American economists and specialists, such as M. N. Baker, of the *Engineering News;* Prof. John R. Commons, F. A. C. Perrine, Frank Parsons, Max West and Prof. Bemis himself. They treat the subjects of Water Works, Municipal Electric Lighting, the Telephone, Municipal Franchises, Street Railways, Gas, etc., in a thoroughly scholarly and practical manner. The book is published by T. Y. Crowell & Co., and sold at $2, carriage prepaid to any address.

* * *

"The Theory and Practice of Taxation," by David A. Wells, LL. D., is one of the most valuable works upon the question of taxation which has been published in a long time. It has 648 pages, the contents of which are thoroughly indexed. The subject is discussed from a broader basis and the principles of taxation are shown up by different methods than have heretofore been attempted, special attention being given to the experience in the United States. Various members of a city's administration will be deeply interested in this work, and it should find a place in every municipal library. It is published by D. Appleton & Company, New York, and sold for $2, postage prepaid.

* * *

D. Appleton & Company, New York, have recently published a new and revised edition of "Tables of Weights, Measures, Coins, etc., of the United States and England, with their equivalents in the Metric System," arranged by T. Egleston, Ph. D., in which many of our readers will be interested. It is put out in 16mo size, bound in flexible leather covers, and may be had from the publishers for fifty cents.

* * *

Some time ago the Baker & Taylor Company, of Union Square, New York, published "The Twentieth Century City," by Josiah Strong, D. D., a booklet which will be of use to the reform element concerned in the affairs of a city, and not without its value to the city officials. It is a book of 186 12mo. pages, bound in cloth, and sells for fifty cents.

* * *

Edward Lloyd, 12 Salisbury Square, E. C., London, England, has just issued "The Municipal Year Book for 1901," which covers the cities of Great Britain, giving a fund of useful and interesting information about English municipalities. "The London Manual for 1901" has also just been brought out by Mr. Lloyd. They contain 556 and 352 pages, respectively, and are sold for half a crown and one shilling and sixpence each. They can be purchased from the publisher or from the JOURNAL.

* * *

"The Scientific American Cyclopædia of Recipes, Notes and Queries," edited by Albert A. Hopkins, is published by Munn & Company, New York. Price, in cloth, $5. It has 750 pages.

This volume is a collection of formulas and recipes collected by Mr. Hopkins, largely from the columns of "Notes and Queries" in the *Scientific American*. Its popularity and value are shown by the

fact that during the past nine years twelve large editions have been exhausted. The present enlarged and revised edition is now ready for delivery, and can be had from the publishers upon receipt of the price.

PERIODICALS

Current periodical literature contains a large amount of matter that is of value to the various departments of city affairs, among which will be found the following:

Housing of the Poor. Monthly Review, New York, March.

Tenement House Problem. Charities Review, New York, March.

Source of Asphalt. By G. Willets. National Magazine, New York.

Engineering Work in the City of Havana. Sanitarian, New York, March.

Organized Charity. By C. B. Patterson. Arena, New York, March.

The English Poor-Law. By Thomas Burke. The Forum, New York, April.

Municipal Art. By E. Graves. American Journal of Sociology, Chicago, March.

Public Provisions for Children. By J. Lee. Charities Review, New York, March.

Politics and the Public Schools. By G. W. Anderson. Atlantic Monthly, Boston, April.

Taxes on Department Stores. By J. A. Hill. Quarterly Journal of Economics, Boston, March.

Neglected Factor in City Saving. By S. Z. Batten. Missionary Review, New York, March.

Engineering Opportunities in Asia. By A. H. Ford. Engineering Magazine, New York, March.

The Next Step in Municipal Reform. By Edwin Burritt Smith. Atlantic Monthly, Boston, April.

Social Settlement Life in Chicago. By Bertha Johnson. Kindergarten Magazine, Chicago, March.

Reform Through Social Work. By Theodore Roosevelt. McClure's Magazine, New York, March.

Civic Reform and Social Progress. By E. R. L. Gould. International Monthly, Burlington, Vt., March.

Municipal Ownership of Naturlay Monopolies. By Richard T. Ely. North American Review, New York, March.

Opposition to Municipal Ownership in England. By H. J. Gibbons. Journal of Political Economy, Chicago, March.

Bertillon System of Identification by the "Speaking Portrait." By W. Douglas. Pearson's Magazine, New York, March.

Election Methods and Reforms in Philadelphia. By Clinton Rogers Woodruff. Annals of the American Academy of Political and Social Science, Philadelphia, March.

MUNICIPAL BONDS IN MARCH.

The sale in municipal bonds and notes for the month of March fell a trifle short of the aggregate sale for the corresponding month a year ago; but the decrease in the total sale of the first quarter as compared with the same period last year is much greater—about $3,200,000. The aggregate sales for the month of March amounted to $11,949,257.

The slump in municipals is undoubtedly due, in a large measure, to the increased investments by trust institutions in railroad bonds. The prevailing high prices that have been asked for municipals has had something to do with the matter. There is likely to be an increase in the annual sale, as the total will be, no doubt, augmented by the sale of foreign municipals in this market. A German municipal loan of 15,000,000 marks sought a market in New York early in the month.

MUNICIPAL JOURNAL AND ENGINEER.

Purchaser.	City and Bonds.	Int. Rate.	Term, Years.	Amount.	Price.
Adams & Co., Boston	Clinton, Mass., Refunding	3½ per cent.	30	9,000	
Ames, A. E. & Co., Toronto	Lindsay, Ont., Town	4 per cent. s. a.	1—20 Ser.	37,017	100.091
Atlas National Bank, Cincinnati	Evanston, O., Woodburn Avenue Improvement	5 per cent.	1—10 Ser.	3,552	101.224
Atlas National Bank, Cincinnati	Evanston, O., Langdon Avenue Improvement	5 per cent.	1—10 Ser.	3,352	101.968
Atlas National Bank, Cincinnati	Evanston, O., Newton Avenue Improvement	5 per cent.	1—10 Ser.	2,185	102.516
Bank of Acadia	Crowley, La., School District	5 per cent.		20,000	Par.
Bank of Commerce, Cleveland	Cleveland, O., Elevated Roadway	4 per cent. s. a.	10	60,000	107.25
Bank of Marysville	Marysville, O., Building	5 per cent. s. a.	5—11½ Ser.	7,000	
Barnum, Lawrence & Co., New York	Binghamton, N. Y., Contingent Fund	3½ per cent. s. a.	7½—15½ Ser.	18,000	
Bloom, Ex-Mayor, S. M.	Hagerstown, Md., Electric Light	4 per cent. s. a.	40—62 Ser.	23,000	108.595
Cantwell, J. A., Utica	Malone, N. Y., School District	4 per cent. s. a.	1—8 Ser.	8,000	102.225
City Savings Bank, Alliance	Ashtabula, O., School District	4½ per cent. s. a.	1—11½ Ser.	25,000	105.40
Cleghorn, J. D. & Co., Minneapolis	Thief River Falls, Minn., Electric Light Plant	5 per cent. a.	15	7,500	105.40
Coffin, Chas. H., Chicago	Gadsden, Ala., Water & School			30,000	Par.
Coffin, Chas. H., Chicago	Greenville, Ala., Water Works	5 per cent. s. a.	30	15,000	Par.
Commercial Savings Bank, Local	Racine, Wis., Paving	4 per cent. s. a.	7—9½ Opt-Avg.	50,000	104.43
Contractor	Remington, Ind., Street Improvement	6 per cent.	1—10 Ser.		
Conway, Gordon & Garnett National Bank	Fredericksburg, Va., Sewer	4 per cent. s. a.	10—30 Opt.	18,000	100.30
Dick Bros. & Co., New York	New Rochelle, N. Y., Street Improvement	3½ per cent. s. a.	10—28 Ser.	38,000	105.43
Edwards, R. J.	Oklahoma City, Okla., City Hall	5 per cent. s. a.	30	30,000	105.75
Erie County Savings Bank, Buffalo	Buffalo, N. Y., Grade Crossing	3½ per cent. s. a.	20	152,804	107.012
Erie County Savings Bank, Buffalo	Buffalo, N. Y., Refunding Water	3½ per cent. s. a.	1—20 Ser.	90,000	104.21
Everett Savings Bank	Everett, Mass., Notes	3½ per cent.	3½ Avg.	3,000	100.89
Exchange National Bank, Mannington	So. Morgantown, W. Va., Street Improvement	5 per cent. a.	10—25 Opt.	10,000	100.50
Farmers' National Bank, Local	Greenville, O., Refunding St. Improvement	5 per cent.	6 mos.	5,550	100.45
Farson, D. M., Chicago	New Albany, Miss., School-House				
Fernald, Geo. A., & Co., Boston	Lawrence, Mass., School	4 per cent. s. a.	½—9½ Ser.	50,000	103.807
Fidelity Trust & Safety Vault Co	Louisville, Ky., Refunding	3½ per cent.	40	597,000	108.125
First National Bank, Barnesville	Proctorville, O., Fire Engine & Public Building	5 per cent. s. a.	4¾—19¾ Opt.	6,000	105.083
First National Bank, Local	St. Mary's, O., Spring St. Assessment	5 per cent. s. a.	1—10 Opt.	11,200	101.785
First National Bank, Local	Troy, O., Funding	4 per cent. s. a.	10	6,000	102.50
First National Bank, Local	Chillicothe, O., Main Street Improvement	4 per cent. a.	8—15 Opt-Avg.	30,500	104.43
First National Bank, Local	Mobile, Ala., Improvement	4 per cent. s. a.	4—20 Opt.	60,000	102.50
First National Bank, Local	Saratoga Springs, N. Y., Sewer & Water	4 per cent. s. a.	6½	5,000	105.00
First National Bank, Local	Saratoga Springs, N. Y., Sewer & Water	4 per cent. s. a.	7¾	5,000	105.04
First National Bank, Local	Saratoga Springs, N. Y., Sewer & Water	4 per cent. s. a.	8½	5,000	106.50
First National Bank, Local	Saratoga Springs, N. Y., Sewer & Water	4 per cent. s. a.	9½	5,000	107.10
First National Bank, Local	Saratoga Springs, N. Y., Sewer & Water	4 per cent. s. a.	10½	5,000	108.51
Hayes, E. W., Local	Louisville, Ky., Refunding	3½ per cent.	40	41,000	109.00
Le Garde, E., & Sons, New Orleans	Iberia & St. Mary, La., Drainage District	5 per cent. a.	30	100,000	103.15
McClure, T. F., & Sons Co., New Orleans	Evanston, O., Montgomery Boulevard	5 per cent.	1—10 Ser.	42,814	103.999
McCurdy, R. M., Local	Youngstown, O., Manning Avenue Grading	5 per cent. s. a.	½—5½ Ser.	2,400	104.950
McCurdy, R. M., Local	Youngstown, O., Lafayette Street Grading	5 per cent. s. a.	½—5½ Ser.		
McDonald, W. J., & Co., Chicago	Russellville, Ala., School, gold	4 per cent. a.	20	12,500	101.50
McGinley, N. D.	Stillwater, Okla., School	6 per cent.	20	6,000	105.075
Morgan, P. W., Local	East Pittsburg, Pa., Street Imp., Sewer & Funding	4½ per cent. s. a.	17 5-6 Avg.	55,000	106.10
Murphy, Hugh, Local	Denver, Col., Capitol Hill Storm Sewer District			4,000	100.80
Mutual Life Assurance Co.	Paris, Ont., Electric Light	4 per cent. s. a.	1—20 Ser.	15,000	102.20
National Bank of New Brighton	New Brighton, Pa., Gold	4 per cent. s. a.	½—3½ Ser.	20,000	101.00
Newman, M. W., Local	New Orleans, La., Judgment	4 per cent. s. a.	24—41 Opt.	115,597	104.00
Ohio National Bank, Local	Columbus, O., School District	3½ per cent.	20	85,000	102.617
New First National Bank, Local	Columbus, O., School District	4 per cent.	7—17 Opt.	32,000	102.263
	Columbus, O., School District	4 per cent.	16	4,000	
Police Pension Fund Trustees					
Pulsifer & Young, Local	Denver, Col., Capitol Hill Storm Sewer District			5,000	101.00
Pulsifer & Young, Local	Denver, Col., No. Denver Grading District			5,000	101.00
Secor & Bell					
Seelig, Baruch, Local	Helena, Ark., Sewer District No. 1—gold	6 per cent. s. a.	20	70,000	105.00
Sinking Fund Commissioners	Everett, Mass., City	4 per cent. s. a.	29	6,000	116.80
Southold Savings Bank	Southold, N. Y., U. F., School District No. 25	4 per cent. s. a.	15¼ Avg.	10,000	110.85
Southold Savings Bank	Southold, N. Y., U. F., School District No. 25	4 per cent. s. a.	3¼ Avg.	2,500	102.35
Stillwater Valley Bank, Covington	Troy, O., Funding	4 per cent. s. a.	10	2,000	106.10
Unknown	Rockwood, Tenn., Electric Light & Water	5 per cent. a.	20	20,000	107.50
Unknown	Sebring, O., Town Hall	5 per cent.	10—21 Ser.	6,000	111.66

RECENT INVENTIONS

666,668.—*Ditching and Grading Machine.* Louis J. Helling and William Koch, Owensville, Mo.

666,725.—*Rubber Tire for Vehicle Wheels.* Rollin S. Woodruff, New Haven, Ct.

666,736.—*Fender for Street Cars.* Luther Case and Henry J. Schuldt, St. Paul, Minn., assignors to Philip W. Herzog, same place.

666,745.—*Water Filter.* William M. Faber and Roland C. Greer, Chicago, Ill.

666,815.—*Safety Device for Street Cars.* Bela Meszaros, Zsidovar and Karoly Molczer and Josef Donagyo, Szabadka, Austria-Hungary.

666,879.—*Fire Escape.* James B. White, Portland, Me., assignor of one-half to Alfred A. White, Bangor, Me.

666,964.—*Car Fender.* Franklin P. Laws, St. Louis, Mo., assignor of one-half to Frank H. Houghton, same place.

666,987.—*Voting Machine.* George W. Trommitz and William H. Powers, Denver, Colo., assignors to the Trommitz Vote Register Co., same place.

667,015.—*Incinerating Vault.* William S. Hull, Jackson, Miss.

667,091.—*Drainage Pump.* Edmund M. Ivens, New Orleans, La.

667,126.—*Smoke Consuming Device for Furnaces.* George S. Gallagher, New York City, assignor to Zilliah B. Gallagher, Emma G. Gallagher and Harry Gallagher, same place.

667,132.—*Street Sweeping Apparatus.* Charles M. Kimball, Toronto, Can.

667,149.—*Fire Apparatus.* Frank E. Kenney, St. Paul, Minn.

667,422.—*Receptacle for Garbage, Ashes, etc.* James Brooks, New York, N. Y.

667,445.—*Garbage Furnace or Crematory.* Eugene J. Little, Daniel C. Shaw and George H. Breymann, Toledo, O.

667,526.—*Fire Escape.* Francis J. Hugh, New York, N. Y.

667,551.—*Grading and Ditching Machine.* William H. Morenus, Lake View, Ia., assignor to Frederick C. Austin, Chicago, Ill.

667,567.—*Conduit for Electric Wires.* Emmett D. Page, New York, N. Y.

667,682.—*Voting Machine.* George W. Crozier, Muncie, Ind.

667,707.—*Dumping Wagon.* George Kautz, Sr., Albany, N. Y.

667,727.—*Automatic Alarm System.* Felix McGloin, New York City, assignor to the Automatic Fire Alarm Co., same place.

667,803.—*Fire Escape.* Julius Stone, Boston, Mass.

667,806.—*Voting Machine.* William A. Swaren, Chicago, Ill., assignor of one-half to Hamilton C. Kibbie, Oblong, Ill.

667,807.—*Voting Machine.* William A. Swaren, Chicago, Ill., assignor of one-half to Hamilton C. Kibbie, Oblong, Ill.

667,818.—*Coin-Controlled Meter.* Joseph A. I. Craig and Charles Page, Montreal, Can., assignors of one-third to Louis Bedard; said Craig assignor of his right to Marie Marguerite Philomen Craig, same place.

667,837.—*Ash Cart.* Carl Brandt, Boston, Mass.

667,871.—*Fireproof Building Structure.* Julian O. Eltinger, Baltimore, Md.

667,931.—*Cover for Ash Carts.* Henry A. Dirkes, New York, N. Y.

667,979.—*Street Car Fender.* George W. Gardner, Philadelphia, Pa.

668,130.—*Mechanical Stoker.* John W. Kincaid, Covington, Ky., assignor of one-third to Charles A. Kincaid, same place.

668,153.—*Car Fender.* Peter Best, Elizabeth, N. J.

668,224.—*Fire Extinguisher.* Orville R. Sackett and Philip J. Keller, Niagara Falls, N. Y.

668,417.—*Voting Machine.* Napoleon B. Ross, Gilboa, O., assignor to The Ross Voting Machine Co., of West Virginia.

668,517.—*Storage Battery Plate.* John Hewitt, Chicago, Ill., assignor to the Hewitt Lindstrom Motor Co., same place.

668,709.—*Flushing-Tank.* Ira P. Clark, Alameda, Cal.

668,762.—*Disinfecting Appliance.* Thomas N. Thompson, Scranton, Pa.

668,770.—*Fender.* William H. Brook, Tyus, Ga.

668,779.—*Apparatus for Controlling Connections of Storage Batteries with Charging Circuits.* Nathan H. Suren, Needham, Mass.

668,787.—*Apparatus for Feeding Liquid and Solid Pulverized Fuel into Furnaces.* Ernest A. Vetillard and Philippe E. Scherding, Jr., Paris, France.

668,824.—*Turbine Water-wheel.* Columbus Stone, Manchester, Tenn.

668,903.—*Electric Bond for Railway Rails.* Harold P. Brown, Montclair, N. J.

668,947.—*Utilization of Waste Materials.* James L. Bell, New York, and Zachary T. Subers, Philadelphia, Pa.

668,977.—*Car Fender.* Adolph G. Carlsen, Chicago.

668,995.—*Sanitary Head Rest for Barbers' or Other Chairs.* Hector Marshal, Port Melbourne, Victoria.

669,054.—*Garbage Crematory.* James L. White, West Superior, Wis.

669,115.—*Water-motor.* John T. Hodges, Rockport, Ind.

668,180.—*Combination Fire-escape and Water-tower.* James Pullar, Hartford, Conn.

669,193.—*Device for Supplying Water to Flush-tanks.* William A. Alexander, Wilkinsburg, Pa.

669,286.—*Water-wheel.* Albert F. Sparks, Springfield, Ohio.

669,310.—*Electric Metering System.* Eustace Oxley, Lynn, Mass.

669,409.—*Apparatus for Handling Ground Finished Cement.* William R. Dunn, Easton, Pa.

669,421.—*Automatic Fire-extinguisher.* George J. Luce, San Francisco, Cal.

669,492.—*Fire Apparatus.* Lester W. Gill, East Somerville, Mass.

669,512.—*Street Sweeper.* Edward S. Day, Worcester, Mass.

669,559.—*Electrical Pliers.* Francis L. Spring, Townsend, Mass.

669,632.—*Garbage-furnace.* Frank Gorman, Toledo, Ohio.

669,656.—*Fire-escape.* Gottfrid Oslund, Worcester, Mass.

669,683.—*Automobile Street-sweeper.* John T. Collins, Hartford, Conn., assignor of one-half to W. L. Curtis, same place.

669,684.—*Street-sweeper.* John T. Collins, Hartford, Conn., assignor of one-half to Waldo L. Curtis, Winsted, Conn.

669,702.—*Process of Sterilizing Milk, etc.* Richard G. Nash, Lucan, near Dublin, Ire.

669,711.—*Trussed Ladder.* Frederick S. Seagrave, Columbus, Ohio.

669,799.—*Ditching-machine.* Frederick Mertsheimer and Job A. Edson, Kansas City, Mo.

669,819.—*Spraying Apparatus or Device.* Matt S. Brooks, Rochester, N. Y.

669,832.—*Combined Telephone and Fire-Alarm Apparatus.* Angus S. Hibbard, Chicago, Ill.

669,845.—*Hose-nozzle.* John H. Melavin, Cambridge, Mass.

669,870.—*Dumping Wagon.* Thomas Wright, Jersey City, N. J.

669,897.—*Apparatus for Preparing and Feeding Fuel.* Albert A. Day, Brooklyn, N. Y.

Construction and Supply

"THE MINER" GLOBE STREET LAMP.

"THE MINER" globe street lamps have been manufactured since 1866 by Thomas T. W. Miner, 821-823 Eagle avenue, and 800 East 159th street, New York. They have been sold all over the United States and have been in use in the principal cities and towns in this and other countries for over thirty-four years. The American Institute, in awarding a bronze medal for these lamps, said: "They are of superior design, construction and finish, and the best lamps made for the purpose."

For use on boulevards they are particularly well adapted, and as corner lamps they go a long way toward solving the vexed question of how to provide street signs which can be read as easily at night as during the day, for they are well adapted for the attachment of signs at the top, naming the streets. The fact that the city of Baltimore has over 6,000 of these lamps in use speaks well for their worth.

THE TAYLOR STEAM ECONOMIST

Is a device for conserving the heat of exhaust steam by using a portion thereof to produce pure feed water, and convert the carbon so generally wasted in smoke and chimney gases into steam generating power.

The device is automatic. It takes nothing from the plant but a portion of the exhaust steam.

It is claimed that fully 50 per cent. saving can be effected in the feed water, and as high as 30 per cent. in the fuel, and all cost of compounds and loss of service from shutting down to clean boilers. It lengthens the life of boilers.

It is sold on an absolute guarantee to effect a saving of at least 20 per cent. in the cost of generating steam. When used to its full capacity it will pay for itself within a year, and its life is from thirty to forty years. For further particulars address Taylor Steam Economist Company, 271 Broadway, New York.

THE IMPROVED ENCLOSED ARCS.

THERE is no scientific field in which there is more satisfactory or rapid advancement than that of electricity. It has come to be that what was announced as an improvement yesterday will be displaced by something better to-day, only to be supplanted to-morrow by something which is still better. Among the latest improvements is to be found an improved enclosed arc lamp, perfected by The Ball Electric System, of 404 West Twenty-seventh street, New York.

Another improvement announced by this company is the Bi-Polar generator. The dynamo has two armatures, which can be operated either in series on one circuit or independently, each on its own circuit, thereby reducing voltage, a desirable feature where economy of

space is required and high voltage an objection, the voltage of such machine being 50 per cent. of the voltage of a single armature machine of equal capacity.

Each armature has its own independent field and regulation, making the circuits electrically separate. A ground on one will not short-circuit to a ground on the other.

MUNICIPAL VOTING BY MACHINERY.

It will not be long before the voting of this Republic will be effected by the machine, not the human machine, but the mechanical. Wherever it is used it covers itself with glory.

Not long ago the city of Binghamton, N. Y., used the Bardwell Votometer in a special election. The results were so satisfactory that a Lestershire nearby village thought it worth while to make a trial of the machine, and at its recent charter election used the Votometer with perfect success. A local paper speaks of the election as follows:

"One of the rapidest and most satisfactory elections ever held in this village passed off at the municipal election last Tuesday by the use of the Bardwell Votometer, whose reliability and accuracy clearly demonstrated that the machine is adapted for use in any election. The mechanical make-up of the machine is so simple that the inspectors manipulated it in distinguishing taxpayers from non-taxpayers without any trouble whatever. The machine is so simply constructed that persons who never saw a voting machine before understood it at a glance and voted their ticket in many instances in less than ten seconds."

The city of Binghamton was so well pleased with its trial of the machine last February that it has just passed an ordinance authorizing the purchase of twenty-four machines.

TRADE PUBLICATIONS.

—The Contractors' Tool Company, 118 S. Sixth street, Philadelphia, Pa., has issued a neat 24-page pamphlet, well illustrated, with copious index, giving a complete list of their supplies, which cover the paving field.

—We are indebted to the United States Sanitary Company, of Washington, D. C., for a copy of the Official Souvenir Programme of the exercises attending the second inauguration of William McKinley, which was gotten out at considerable expense in the interests of the large manufacturers of the Capital City.

—The group of catalogues issued by the Maignen Filtration Company, 1310 Arch street, Philadelphia, Pa., has reached our trade publication corner, and show an unusual amount of good taste and expense in their make-up. Copies can be had for the asking by those city officials who are interested in the subject of water filtration.

—In a neat, double-folded, 16-page catalogue, enclosed between brown covers, artistically printed and profusely illustrated, the Greger Manufacturing Company, of Philadelphia, Pa., tells about the benefits to be derived from the use of its noiseless manhole covers. City officials will learn something to their advantage in reading this pamphlet.

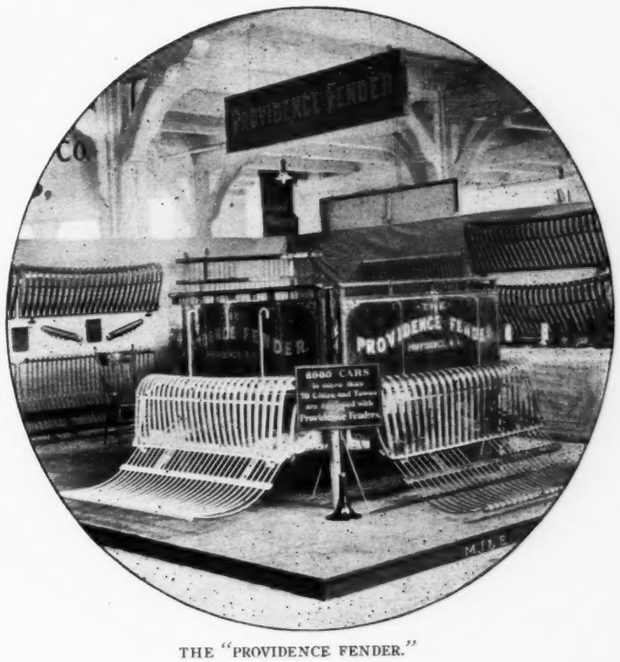
—The Good Roads Machinery Company, of Kennett Square, Pa., is the selling agent for the American Road Machine Company, whose main office and factory are at the same address. In a 36-page illustrated catalogue the products of this concern are attractively placed before the reader, and good taste is displayed in the printing and get-up of the publication.

—Catalogues "E" and "B," together with "Instruction Book G," issued by the Christensen Engineering Company, of Milwaukee, Wis., tell all about the advantages of using air-brakes on the street railway car. These books are made complete without apparent regard to cost, every phase of the subject being made more clear by the use of expensive plates or illustrations. They can be had on application to the company.

—The Sprague Electric Company, of New York City, with its usual enterprise, has opened the trade publication season with a full line of timely catalogues, covering the electrical field. The covers and contents are gotten up in good taste. Three of these special numbers have reached us already—"Bulletin No. 205," one on "Lundell Fan Motors," and another on "Interior Conduit." All the catalogues are well indexed, and contain price-lists.

A MEANS OF SAVING LIFE.

The citizen demands rapid transit, and this demand necessitates a high rate of speed to be maintained by the street railway car. This means an increased danger to the pedestrian, but it is impossible to lessen the danger by reducing the speed of the car without largely decreasing the value of this means of transportation, for the busy man must "get there" at whatever cost. For this reason, devices for lessening liability to injury and loss of life have been invented, one of the most notable being the street car fender. In this connection it is interesting to note that 95 per cent. of all car fenders used



THE "PROVIDENCE FENDER."

in the world, other than those made by the electric roads themselves, have been made by the Consolidated Car Fender Company, 39 Cortlandt stret, New York. The fender is known as the "Providence."

It is in practical operation on more than 7,500 cars in service on 115 electric roads in 200 cities and towns in the United States, South America and Europe. The accompanying illustration will show what it is like.

MINERAL WOOL.

Mineral wool is essentially a vitreous substance converted to a fibrous condition. It has the appearance of small fibres interlacing each other, forming innumerable minute air cells. The resemblance of this to wool or cotton has given the name "mineral wool" in this country and "silicate cotton" elsewhere.

One of the most important qualities of mineral wool is its unequaled power to resist the transmission of heat and cold; no other material which can be used approaches this as a non-conductor of either extremes.

Its use in the protection of water pipe from the attacks of "Jack Frost" in all places where exposures occur, by civic authorities and private corporations is very extensive.

It is practically indestructible by heat, and when used in the construction of buildings will positively check the spread of any fire, no matter how fiercely the fire may burn.

This wool also possesses another characteristic of great value, as it is a non-conductor of sound. For this reason it is indispensable as a "deadener" or "deafener" of the floors and walls of buildings. Scientific anaylsis has proven it to be a silicate of magnesia, lime, alumina and soda; consequently neither rats, mice, insects or disease germs can live in it.

THE MODERN FIRE ALARM TELEGRAPH.

To be efficient, a fire alarm telegraph system must be unerring and swift in announcing a call, and must be protected in every way possible against an interruption of service from whatever cause.

Economy, first cost and maintenance, are desirable considerations, but it is a great mistake to be influenced by these considerations if in so doing the accuracy, dispatch, or immunity from interruptions of the service is to be in any way sacrificed.

The system and apparatus which are put on the market by the Star Electric Company, Binghamton, N. Y., are of the modern type, best calculated to conserve the interests of a fire protective organization.

AN IMPROVEMENT FOR HARTFORD.

The city of Hartford, Conn., is soon to have its street railway tracks greatly improved, thanks to the progressive corporation which owns the road.

The old style rail, which has been down for years, became so objectionable not only to the company, but also to the citizens—particularly to those who owned trucks, wagons or carriages—that the decision to convert the old styled rail into the modern grooved rail, by means of the Buckland Paving Block, has been received with warm approval. The block is made by the American Street Railway Paving and Improving Company, Springfield, Mass.

The change will be made as rapidly as may be found consistent with good judgment. The city officials in other municipalities will act wisely if they look into this matter with a view to inducing the street railway authorities to use this modern device.

AIR BRAKES FOR STREET RAILWAYS.

THE promoters of street railway lines are continually on the lookout for means to lessen the possibility of accident to pedestrians crossing the tracks in countless numbers every day in the large city. The air brake, as adapted to street car use, manufactured by the Christensen Engineering Company, of Milwaukee, Wis., has long been recognized by most street railway people as an absolute necessity to the reduction of the number of accidents. By some people it is looked upon as a matter of economy, as its use saves thousands of dollars that are otherwise spent annually in contesting claims for damages from persons who have been more or less injured by the street railways.

It is now time for the various city officials throughout the country, especially those who have the welfare of the general public at heart, to take counsel with the street railway people, and at the same time learn something about this wonderful invention, in order that intelligent co-operation may be given the street railway officials in rapidly installing this system of air brakes. The system should be used on all street railways.

TRADE NOTES.

—The Star Fire Extinguisher has some novel features, and has been used with success by many private concerns as well as fire departments. It is made at Lawrence, Mass., by C. N. Perkins & Co.

—The New York Continental Jewell Filtration Company has been awarded the contract for installing a mechanical filtration plant at Little Falls, N. J., for the East Jersey Water Company. The plant will have a daily capacity of 32,000,000 gallons.

—The Greger Manufacturing Company, of Philadelphia, Pa., has special facilities for making all kinds of municipal, street railway and general street and roadway engineering, sewers, subways, conduits, etc. Its noiseless manhole cover is unique and should be used in every city in the United States.

—The Indianapolis *News* of March 22d says: "The Board of Public Safety to-day contracted with The Seagrave Company, of Columbus, O., for a chemical engine and two service trucks for $4,800." This shows that the city of Indianapolis knows where to get "good goods" and the worth of its money.

—The Shadbolt Manufacturing Company, of Brooklyn, N. Y., builds wagons to carry anything that is dumped in bulk, of varying size and capacity. Just at present the company is constructing ten wagons of large size, having a capacity of six tons, for the Crescent Trucking Company, of New York. It has just shipped four two-horse garbage wagons to the city of Lancaster, Pa.

—One of the Gamewell Company's experts has just returned from New Orleans, where he has successfully installed a complete Gamewell system of fire alarm, equal to anything that has ever been put in. Local papers speak in the highest terms of the installation. This company has received an order for the installation of its fire alarm system for Manchester, England. It has lately installed its fire alarm system in Woodgreen, a suburb of London.

—The Portland Extension Ladder Company, 28 Plane street, Newark, N. J., manufactures the patent self-locking extension ladder, which is called the "Flying Yankee." The company claims that it is fifty years ahead of all others as a movable fire-escape. It is automatic, and specially adapted to the use of fire departments. J. A. Weston, the manager of the company, has just patented a new fire ladder which he calls the "Truss," on account of its construction. It has been tested to stand 700 pounds in the middle.

—The "Diggs Fire Extinguisher" is made in New York, at 143 Centre street, by D. W. Diggs. If you prefer the reversible, this machine is offered as an improvement on this type. It is simplicity itself, and cannot get out of order. Comander James M. Miller, of the *Ajax*, United States Navy, says of this extinguisher: "I carried one of the Diggs fire extinguishers with me in my cabin on the U. S. S. *Badger* around the world. It did yeoman work on our voyage from Gibraltar. We used it twice with great success."

—The Endless Emergency Fire Escape is for use in the private home, office buildings, factories, hotels, and should be in the outfit of every travelling salesman. Fire commissioners, fire chiefs, public building inspectors in every American city should see that all public buildings, factories,etc., are supplied with an adequate number of fire escapes. Too great care cannot be exercised in this direction. The "Endless" is manufactured by Ives & Son, 2293 Third avenue, New York. It has been recommended by Chief Foley, of the Milwaukee (Wis.) Fire Department.

—The Ericsson Telephone Company, of 296 Broadway, New York, is issuing what it calls "The Ericsson Series," which treat practical phases of the telephone question of great interest to telephone people, independent and otherwise. The fifth part of Volume I has just come to hand, and treats of the transposition of wires, iron and copper circuits and the use of copper sleeves. Besides this it contains a lot of useful information relating to telephone lines and prices as found in some foreign countries. Anyone wishing to avail himself of this "series" can do so without cost by sending his address to the company.

Supplement to the Municipal Journ

The Winchester System of Ele

First Used by the Municipal Lighting Plant of

SCHEDULE NO. 1.

RATES FOR COMMERCIAL LIGHTING, 16 CANDLE POWER LAMPS.

FOR STORES, OFFICES, CLUB ROOMS, PUBLIC PLACES ETC.

WINCHESTER SYSTEM.

TEMPORARY SERVICE, FOR RATES (UNDER 60 DAYS, PAYABLE IN ADVANCE,) FIND IN THE TABLE BELOW, THE MONTHLY RATE CORRESPONDING TO SERVICE REQUIRED, FOR 24 OR 12 HOUR SERVICE ADD 10%, FOR 5 HOUR 15%, FOR 3 HOUR 20%, DIVIDE BY DAYS PER MONTH, MULTIPLY BY NIGHTS REQUIRED AND MULTIPLY BY No OF LAMPS.

AVERAGE LIGHTING PERIOD.		AVERAGE HOURS PER RUN PER MONTH.				AVERAGE RATE PER 16 C.P. LAMP PER MONTH.	RATES PER 16 C.P. LAMP PER MONTH.				RATE PER 16 C.P. LAMP PER YEAR.
DAYS, OR RUNS PER MONTH.	HOURS PER RUN.	FEB. MAR. APR.	MAY. JUNE. JULY.	AUG. SEP. OCT.	NOV. DEC. JAN.		FEB. MAR. APR.	MAY. JUNE. JULY.	AUG. SEP. OCT.	NOV. DEC. JAN.	
30 TIMES PER MONTH, (EVERY DAY.)											
30.	24	24	24	24	24	1.98	1.98	1.98	1.98	1.98	23.76
	12	12	9	12	15	.99	.99	.75	.99	1.23	11.88
	5	5	3½	5	6½	.75	.75	52	.75	.98	9.00
	3	3	1½	3	4½	.50	.50	.25	.50	.75	6.00
26 TIMES PER MONTH, (6 TIMES PER WEEK.)											
26.	24	24	24	24	24	1.72	1.72	1.72	1.72	1.72	20.64
	12	12	9	12	15	.86	.86	.64	.86	1.08	10.32
	5	5	3½	5	6½	.65	.65	.45	.65	.85	7.80
	3	3	1½	3	4½	.43	.43	.22	.43	.64	5.16
13 TIMES PER MONTH, (3 TIMES PER WEEK.)											
13.	24	24	24	24	24	.86	.86	.86	.86	.86	10.32
	12	12	9	12	15	.43	.43	.32	.43	.54	5.16
	5	5	3½	5	6½	.36	.36	.26	.36	.46	4.32
	3	3	1½	3	4½	.22	.22	.12	.22	.32	2.64
9 TIMES PER MONTH, (2 TIMES PER WEEK.)											
9.	24	24	24	24	24	.72	.72	.72	.72	.72	8.64
	12	12	9	12	15	.36	.36	.28	.36	.44	4.32
	5	5	3½	5	6½	.25	.25	.18	.25	.32	3.00
	3	3	1½	3	4½	.15	.15	.08	.15	.22	1.80
4½ TIMES PER MONTH, (1 TIME PER WEEK.)											
4½	24	24	24	24	24	.48	.48	.48	.48	.48	5.76
	12	12	9	12	15	.24	.24	.18	.24	.30	2.88
	5	5	3½	5	6½	.13	.13	.10	.13	.16	1.56
	3	3	1½	3	4½	.08	.08	.04	.08	.12	.96

· NOTES ·

FOR REGULAR SERVICE THE MINIMUM MONTHLY RATE SHOULD NOT BE LESS THAN $1.00 EXCEPT WHEN LESS THAN THREE 16 C.P. LAMPS ARE IN USE OR WHEN LIGHTING IS NOT USED OFTENER THAN ONCE A WEEK.

THESE RATES ARE BASED ON AN APPROXIMATE AVERAGE OF ½ CENT PER 16 C.P. LAMP HOUR, THE CHARGES BEING ARRANGED SO THAT THEY ARE HIGHER THAN THE AVERAGE DURING HEAVY LOAD OR SHORT SERVICE, AND LOWER THAN THE AVERAGE DURING LIGHT LOAD AND LONG SERVICE.

THE FIRST INSTALLATION OF LAMPS SHOULD BE FURNISHED FREE TO EACH CONSUMER, (INCLUDING RENEWALS FOR DEFECTIVE LAMPS, WHICH HAVE NOT DEVELOPED A PROPER LENGTH OF LIFE.)

ALL LAMPS SHOULD BE MARKED FOR IDENTIFICATION AND DATED WHEN INSTALLED, AND ALL RENEWALS, (EXCEPT AS ABOVE) SHOULD BE SUPPLIED AT REASONABLE RATES TO THE CONSUMER. THUS THE CONSUMER WILL BE INDUCED TO ECONOMIZE IN THE USE OF HIS LAMPS SO AS TO PROLONG THEIR PERIOD OF USEFULNESS, AND WILL INCIDENTLY AID THE PRODUCER BY THE SAVING OF CURRENT THAT MUST FOLLOW. WHETHER THE CONSUMER HAS BEEN FAITHFUL TO HIS CONTRACT CAN BE READILY DETERMINED BY THE FREQUENCY OF HIS CALLS FOR RENEWALS; NO RENEWALS SHOULD BE GIVEN EXCEPT IN EXCHANGE FOR THE BURNED OUT LAMPS BY THIS METHOD, AND OCCASIONAL INSPECTION OF THE CONSUMER'S PREMISES, NOT ONLY WILL THE USE OF FOREIGN LAMPS BE DETECTED BUT THE DATES ON THE BURNED OUT LAMPS WILL SHOW, WHEN COMPARED TO THE CONTRACT TIME, WHETHER THE LAMPS HAVE HAD A REASONABLE LENGTH OF LIFE OR NOT.

A DEPOSIT SHOULD BE HELD FOR THE RETURN OF TEM'RY LAMPS.

LAMPS IN CELLARS, ATTICS ETC .10 .15 .20 & .25 CENTS PER MONTH, ACCORDING TO FREQUENCY OF USE.

RATE

THESE R
TO BE EXCES

AVERAGE LIGHTING PER AND CLASS NO	
DAYS OR RUNS PER MONTH.	HOURS
No 1.	
30	A 6 H PE
No 2.	
30	A 4½ PE
No 3.	
30	A 3½ PE
No 4.	
30	A 2½ PE
No 5.	
IRREGULAR	
30	

FOR RES
NUMBER OF
BE ALLOWE
10 TO 14 LA
15 " 44
45 " 74

The subject of selling electrical energy for all purposes with mutual satisfaction to the consumer and the plant was an important and co not settle on any of those in use, as they were either unadaptable, unyielding or unfair one way or the other. We were then confronted with the on from all information gleaned upon the subject was looked upon as a sort of breeder of contention between the consumer and producer, especially so Not only this, but it was found to be a very costly adjunct to a small plant in the way of repairs, necessary attention and settlement of misunderstа that we believed it to be for the best interest of all concerned, to avoid the use of meters, as far as possible if not entirely. To this end we again tur complished by reducing all forms of service to individual rates covering all costs, upon a sliding scale variable according to the different lengths o lamps shall be supplied free, and it is conditional that the consumer shall purchase all lamp renewals of the plant, at lower rates than they can be preventing the use of other lamps and encouraging the consumer to economize in the use of current by making it to his advantage to prolong the l only fluctuation to the yearly rate which is otherwise fixed, will be made by the purchase of lamp renewals. If renewals are too frequent in some amount of time limit stipulated in the contract, the consumer's attention can be called to such fact and provision made either for an increased rat in use three years. All lamps are dated as delivered to the consumer.—A. E. Winchester, South Norwalk, Conn.

the Municipal Journal ar

The Winchester System of Electric Lig

First Used by the Municipal Lighting Plant of South Norw

NO. 1.

NG, 16 CANDLE POWER LAMPS.

ROOMS, PUBLIC PLACES ETC.

TEM.

TABLE IN ADVANCE,) FIND IN THE TABLE BELOW, THE MONTHLY RATE 10%, FOR 5 HOUR 15%, FOR 3 HOUR 20%, DIVIDE BY DAYS PER MONTH, MULTIPLY BY NIGHTS REQUIRED AND MULTIPLY BY No OF LAMPS.

RATES PER 16 CP LAMP PER MONTH.				RATE PER 16 CP LAMP PER YEAR.
EB. AR. PR.	MAY. JUNE. JULY.	AUG. SEP. OCT.	NOV. DEC. JAN.	
DAY.)				
.98	1.98	1.98	1.98	23.76
.99	.75	.99	1.23	11.88
.75	.52	.75	.98	9.00
.50	.25	.50	.75	6.00
PER WEEK.)				
.72	1.72	1.72	1.72	20.64
.86	.64	.86	1.08	10.32
.65	.45	.65	.85	7.80
.43	.22	.43	.64	5.16
PER WEEK.)				
.86	.86	.86	.86	10.32
.43	.32	.43	.54	5.16
.36	.26	.36	.46	4.32
.22	.12	.22	.32	2.64
ER WEEK.)				
.72	.72	.72	.72	8.64
.36	.28	.36	.44	4.32
.25	.18	.25	.32	3.00
.15	.08	.15	.22	1.80
ER WEEK.)				
.48	.48	.48	.48	5.76
.24	.18	.24	.30	2.88
.13	.10	.13	.16	1.56
.08	.04	.08	.12	.96

NOTES

FOR REGULAR SERVICE THE MINIMUM MONTHLY RATE SHOULD NOT BE LESS THAN $1.00 EXCEPT WHEN LESS THAN THREE 16 C.P. LAMPS ARE IN USE OR WHEN LIGHTING IS NOT USED OFTENER THAN ONCE A WEEK.

THESE RATES ARE BASED ON AN APPROXIMATE AVERAGE OF ½ CENT PER 16 C.P. LAMP HOUR, THE CHARGES BEING ARRANGED SO THAT THEY ARE HIGHER THAN THE AVERAGE DURING HEAVY LOAD OR SHORT SERVICE, AND LOWER THAN THE AVERAGE DURING LIGHT LOAD AND LONG SERVICE.

THE FIRST INSTALLATION OF LAMPS SHOULD BE FURNISHED FREE TO EACH CONSUMER, (INCLUDING RENEWALS FOR DEFECTIVE LAMPS, WHICH HAVE NOT DEVELOPED A PROPER LENGTH OF LIFE.)

ALL LAMPS SHOULD BE MARKED FOR IDENTIFICATION AND DATED WHEN INSTALLED, AND ALL RENEWALS, (EXCEPT AS ABOVE) SHOULD BE SUPPLIED AT REASONABLE RATES TO THE CONSUMER. THUS THE CONSUMER WILL BE INDUCED TO ECONOMIZE IN THE USE OF HIS LAMPS SO AS TO PROLONG THEIR PERIOD OF USEFULNESS, AND WILL INCIDENTLY AID THE PRODUCER BY THE SAVING OF CURRENT THAT MUST FOLLOW. WHETHER THE CONSUMER HAS BEEN FAITHFUL TO HIS CONTRACT CAN BE READILY DETERMINED BY THE FREQUENCY OF HIS CALLS FOR RENEWALS, NO RENEWALS SHOULD BE GIVEN EXCEPT IN EXCHANGE FOR THE BURNED OUT LAMPS BY THIS METHOD, AND OCCASIONAL INSPECTION OF THE CONSUMER'S PRENISES, NOT ONLY WILL THE USE OF FOREIGN LAMPS BE DETECTED BUT THE DATES ON THE BURNED OUT LAMPS WILL SHOW, WHEN COMPARED TO THE CONTRACT TIME, WHETHER THE LAMPS HAVE HAD A REASONABLE LENGTH OF LIFE OR NOT.

A DEPOSIT SHOULD BE HELD FOR THE RETURN OF TEM'RY LAMPS.

LAMPS IN CELLARS, ATTICS ETC .10 .15 .20 & .25 CENTS PER MONTH, ACCORDING TO FREQUENCY OF USE.

RATES FOR DOM

THESE RATES ARE FOR MAX
TO BE EXCESSIVELY USED. FOR LI

AVERAGE LIGHTING PERIOD, AND CLASS No.		LOCATION
DAYS OR RUNS PER MONTH.	HOURS PER RUN.	NAME O OR PL
No 1. 30	ABOUT 6 HOURS PER LT.	LONG BURNING L HALLS, VEST ROOMS, WATE OTHER LOCATIO LONG SERVICE. WITH 3 OR MORE ONE MAY BURN ALL NI
No 2. 30	ABOUT 4½ HRS. PER LT.	AVERAGE SERVICE ROOMS, READING R (LIBRARIES USED A (RECEPTION ROOMS ROOMS,) DINING RO PANTRIES.
No 3. 30	ABOUT 3½ HRS. PER LT.	AVERAGE SERVICE DRAWING ROOMS, (L TION ROOMS, NOT US ROOMS,) MUSIC R ROOMS.
No 4. 30	ABOUT 2½ HRS. PER LT.	SHORT SERVICE ENTRYS, BATH ROO ETS, USED ONLY AS CHAMBERS, DRES ING ROOMS, NURSE
No 5. IRREGULAR.		LAUNDRIES, CELLA ROOMS, (ENTRYS S CONSERVATORIES, LAB, CORNICES, PR
30	12	REGULAR ALL NI

FOR RESIDENCES USING LIGH
NUMBER OF ROOMS, NUMBER OF LAM
BE ALLOWED FROM THE LUMP RA

10 TO 14 LAMPS,	10 %	75 TO 99	
15 " 44	" 15 %	100 AND OVER	
45 " 74	" .20-25 %	CONNECTED,	

rposes with mutual satisfaction to the consumer and the plant was an important and complicated problem to aptable, unyielding or unfair one way or the other. We were then confronted with the only alternative, the elec upon as a sort of breeder of contention between the consumer and producer, especially so with regard to small to a small plant in the way of repairs, necessary attention and settlement of misunderstandings. These thing ied, to avoid the use of meters, as far as possible if not entirely. To this end we again turned to the contract sy rates covering all costs, upon a sliding scale variable according to the different lengths of lighting periods o consumer shall purchase all lamp renewals of the plant, at lower rates than they can be otherwise bought in nsumer to economize in the use of current by making it to his advantage to prolong the life of his lamps as fa d, will be made by the purchase of lamp renewals. If renewals are too frequent in some instances, the cause c mer's attention can be called to such fact and provision made either for an increased rate or a reduction in th e consumer.—A. E. Winchester, South Norwalk, Conn.

and Engineer, May, 1901

Lighting Rates

Norwalk, Connecticut

SCHEDULE NO. 2.

DOMESTIC LIGHTING, 16 CANDLE POWER LAMPS.

FOR RESIDENCES.

WINCHESTER SYSTEM.

OR MAXIMUM SERVICE AND SHOULD BE MAINTAINED IN ALL INSTANCES WHERE SERVICE IS LIKELY
FOR LIGHT SERVICE, SEE DISCOUNTS BELOW THIS TABLE.

ATION OF LAMPS, NAME OF ROOM OR PLACE.	NUMBER OF LAMPS.	AVERAGE RATE PER MONTH.	RATES PER MONTH. FEB. MAR. APR.	MAY. JUNE. JULY.	AUG. SEP. OCT.	NOV. DEC. JAN.	RATE PER YEAR.
RNING LAMPS FOR S, VESTIBULES, BATH S, WATER CLOSETS, OR LOCATIONS REQUIRING ERVICE.	1	.76	.76	.38	.76	1.14	9.12
	2	1.28	1.28	.64	1.28	1.92	15.36
	3	1.50	1.50	.75	1.50	2.25	18.00
	4	1.70	1.70	.85	1.70	2.45	20.40
	5	1.90	1.90	1.15	1.90	2.65	22.80
RMORE EACH ADDITIONAL LAMP .20			.20	.20	.20	.20	2.40
URN ALL NIGHT, WHEN REQUIRED.							
SERVICE FOR SITTING EADING ROOMS, STUDIES, ES USED AS SITTING ROOMS, ON ROOMS USED AS SITTING DINING ROOMS, KITCHENS, S.	1	.50	.50	.25	.50	.75	6.00
	2	.76	.76	.38	.76	1.14	9.12
	3	1.00	1.00	.50	1.00	1.50	12.00
	4	1.15	1.15	.65	1.15	1.65	13.80
	5	1.30	1.30	.80	1.30	1.80	15.60
	6	1.45	1.45	.95	1.45	1.95	17.40
EACH ADDITIONAL LAMP .15			.15	.15	.15	.15	1.80
SERVICE FOR PARLORS, ROOMS, (LIBRARIES, RECEP MS, NOT USED AS SITTING MUSIC ROOMS, BILLIARD	1	.40	.40	.20	.40	.60	4.80
	2	.60	.60	.30	.60	.90	7.20
	3	.80	.80	.40	.80	1.20	9.60
	4	.95	.95	.55	.95	1.35	11.40
	5	1.10	1.10	.70	1.10	1.50	13.20
	6	1.25	1.25	.85	1.25	1.65	15.00
EACH ADDITIONAL LAMP .15			.15	.15	.15	.15	1.80
ERVICE FOR (HALLS, SIDE BATH ROOMS, WATER CLOS- D ONLY AS REQUIRED,) S, DRESSING ROOMS, SEW- S, NURSERIES.	1	.30	.30	.15	.30	.45	3.60
	2	.50	.50	.25	.50	.75	6.00
	3	.70	.70	.35	.70	1.05	8.40
	4	.85	.85	.50	.85	1.20	10.20
	5	1.00	1.00	.65	1.00	1.35	12.00
	6	1.15	1.15	.80	1.15	1.50	13.80
EACH ADDITIONAL LAMP .15			.15	.15	.15	.15	1.80
S, CELLARS, ATTICS, STORE ENTRYS SELDOM USED.) ATORIES, PORCHES CUPO- NICES, PRIVATE STABLES,	1	.20	.20	.20	.20	.20	2.40
	2	.40	.40	.40	.40	.40	4.80
	3	.60	.60	.60	.60	.60	7.20
	4	.75	.75	.75	.75	.75	9.00
	5	.90	.90	.90	.90	.90	10.80
EACH ADDITIONAL LAMP .10 TO .20 ACCORDING TO PROBABLE USE.							
RALL NIGHT LAMPS.	1	.99	.99	.50	.99	1.48	11.88
NG LIGHT AVERAGE SERVICE, (WHICH MAY BE DETERMINED BY SIZE OF FAMILY, R OF LAMPS PER ROOM, SOCIAL CONDITIONS ETC.,) THE FOLLOWING DISCOUNTS MAY UMP RATES RESULTING FROM THE ABOVE TABLE,							
TO 99 LAMPS DEDUCT 5%.	CLASS 1.	.12	.06	.12	.18	1.44	
AND OVER CHARGE FOR EACH LAMP	" 2.	.09	.06	.09	.18	1.26	
NECTED, RATES AS HERE SHOWN.	" 3.	.09	.06	.09	.18	1.20	
	" 4.	.09	.06	.09	.18	1.44	
	" 5.	.12	.12	.12	.12	1.44	

.NOTES.

NO ALLOWANCE FOR NON-USE BY ABSENCE SHOULD BE GIVEN UNLESS NOTIFIED IN ADVANCE, AND THEN ONLY FOR A PERIOD OF NOT LESS THAN 30 DAYS.

MINIMUM MONTHLY RATE SHOULD NOT BE LESS THAN $ 1.00

THE FIRST INSTALLMENT OF LAMPS SHOULD BE FURNISHED FREE TO EACH CONSUMER. SEE NOTES ON COMMERCIAL SCHEDULE, NO. 1.

blem to deal with as we learned the more we considered it. We favored a contract system, but could the electric meter, which we knew in its perfection to be true and reliable, but for mysterious reasons o small plants, though the average results from the use of meters were satisfactory to large producers. se things and more of the same nature were weighed against the advantages of meters, with the result ntract system and finally developed an original plan upon which to fix and control rates, which was ac- riods of the different seasons. As a check upon this method, it is provided that the first installment of ght in small quantities, and each lamp requiring to be replaced, must be returned and identified, thus os as far as possible, which has an effect similar to a meter, without its possible disadvantages, as the cause can easily be discovered by this method, and if it is found that the use of current exceeds the on in the use of the current to its proper limit. This contract rate system is very satisfactory after being